

ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE.

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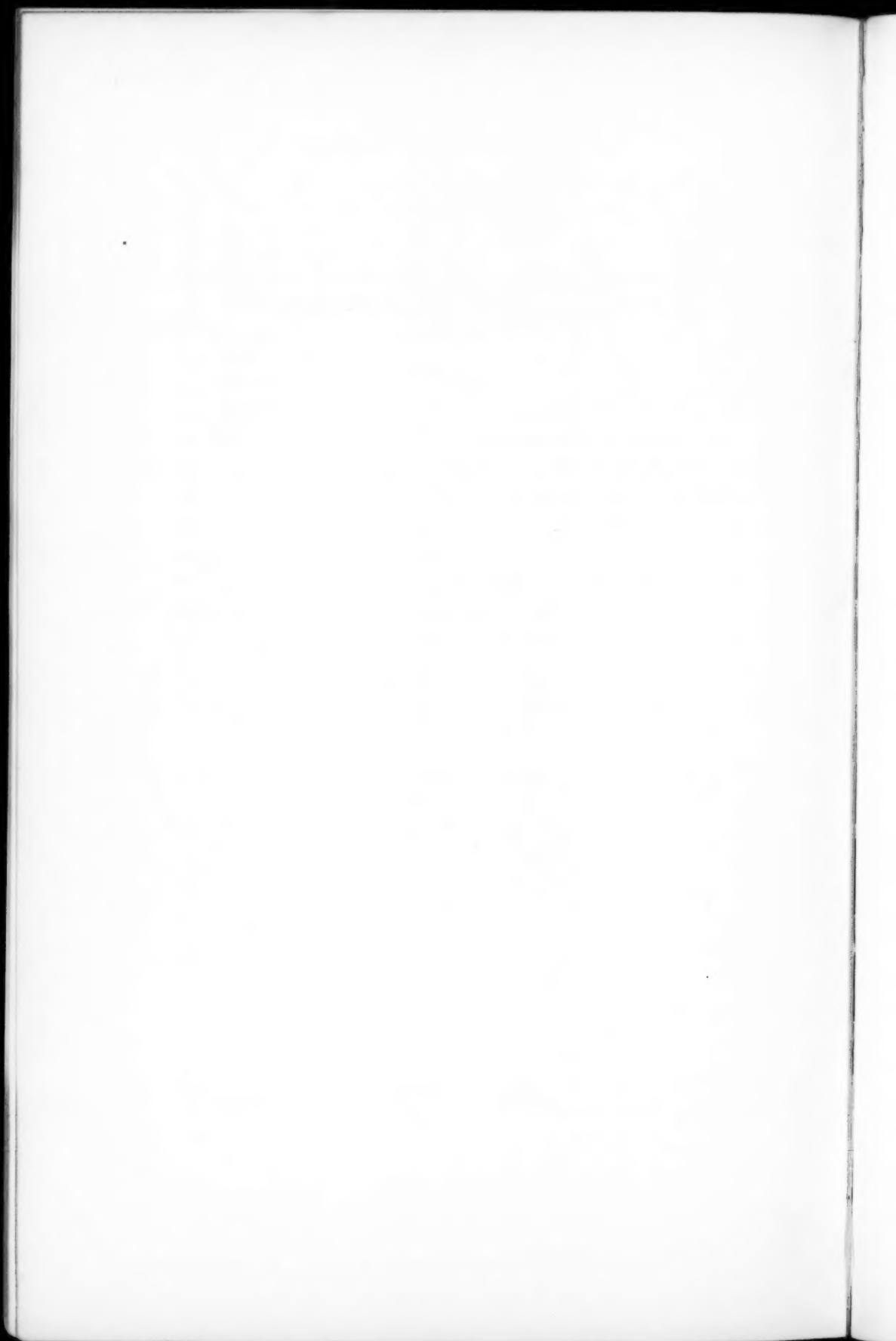
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SURGICAL LITERATURE ABSTRACTS ARE
PUBLISHED.

	PAGE
BLAUDEL, C., DR., Tübingen	446
CHLUMSKY, V., DR., Würzburg	452
LAUENSTEIN, C., DR., Hamburg	451
LINSER, P., DR., Tübingen	450
LOOS, DR., Tübingen	445
POUSSON, A., DR., Paris	444
ROTHSCHILD, O., DR., Frankfurt	448
SCHOCH, E., DR., Münsterlingen	450
VON EISELSBERG, DR., Königsberg	447



ANNALS OF SURGERY.

RADICAL CURE OF INGUINAL AND FEMORAL HERNIA, WITH A REPORT OF EIGHT HUN- DRED AND FORTY-FIVE CASES.¹

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THE decade that has just passed may be said to have practically settled the question as to the possibility of curing inguinal and femoral hernia by operative methods of treatment. Prior to this time, although numerous methods had been enthusiastically advocated and had been tried, even with all the advantages of antiseptic technique, the results were such as to go far towards justifying the opinion of the more conservative and judicial surgeons, that these operations were not entitled to the term "Radical Cure," and were often of very doubtful efficacy. To-day the whole attitude of surgeons towards the operative relief of hernia has entirely changed, and the general practitioners as well, are waking up to the fact that the time has now come when, instead of selecting special cases of hernia for operation, they may better select special cases for truss treatment. This change has been due to two factors, first, the steady decrease in the mortality attending operation, and, second, the vastly improved results that have followed improved methods and improved technique.

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Whereas, ten years ago the mortality of operation for non-strangulated hernia in four of the largest London hospitals was six per cent., to-day, in competent hands, the mortality is less than one-half of one per cent., or practically *nil* in uncomplicated cases. The early mortality was sufficient to deter conservative surgeons from advising operation in persons but little inconvenienced by wearing a truss, and when in addition to this there was the fact that 40 to 50 per cent. of the cases relapsed within two or three years after operation, it was no wonder that many patients who understood the situation were unwilling to try operative treatment.

In no department of abdominal surgery, the world over, has there been more earnest and untiring work done than in the operative treatment of hernia; and, although I believe that the method introduced by Bassini in 1890 marks the highest point in the evolution of an ideal operation for hernia, much honor and credit are due to other men who have devised methods but little short of his in value.

I shall first consider the radical cure of inguinal hernia in the male. What are the indications for operation? A decade ago operative treatment was restricted to very large herniæ or to irreducible herniæ, or herniæ difficult or impossible of control by mechanical means. To-day the indications are much wider in scope. Operation may be advised in all adults under fifty years of age in good health, except in cases of very large, irreducible scrotal hernia. I would also except very large reducible herniæ of long standing, in which the reduction of the contents into the abdomen materially increases the tension of the abdominal walls and interferes with respiration. Operation in these cases is not free from risk, and the chances of obtaining a permanent cure are slight. On the other hand, there are many patients, even up to the age of seventy, with hernia which, though not of great size, are very difficult to control with truss, and the danger of strangulation is ever present. Such patients, if in good health and not too obese, are proper subjects for operative treatment.

The indication for operative intervention in children requires separate consideration. When I published my first paper upon the radical cure of hernia in children with a report of fifty cases, in 1893, the criticism was made by some surgeons that hernia in children should not be operated upon, inasmuch as it could always be cured by mechanical means. As a reply to this criticism I made an analysis of upwards of 15,000 cases of hernia in adults observed at the Hospital for Ruptured and Crippled in New York, with a view of ascertaining as nearly as possible how many gave a history of hernia in infancy and childhood. A careful study of these cases warranted the conclusion that at least one-third of all infants and children under fourteen, with inguinal hernia, are not cured by mechanical treatment, and hence the employment of operative methods in hernia occurring in children is entirely justified, provided these methods are free from risk. The only death I have had in upward of 500 hernia operations in children was due to double pneumonia following ether. Therefore, it may safely be stated that the risk is not appreciable.

Since the publication of the paper referred to, there has been a constant tendency to extend, more and more, radical cure methods to children, until at present we are regarded at the Hospital for Ruptured and Crippled as ultra-conservative. Instead of operating upon the majority of children and infants of all ages, as is recommended by many of the French surgeons, and is the practice of not a few American surgeons, our plan is to operate very rarely under the age of four years. Most patients with inguinal hernia under the age of four years may be cured with a truss, and it is well to give them the trial. After the age of four years, and up to fourteen years, we advise truss treatment for one or two years, at the end of which time, if the hernia still comes down and the ring is large, we believe there is little to be gained by waiting, and advise operation. Among dispensary patients it is often difficult to provide the proper care at home in the management of the truss necessary to

success, and in such cases the question of operating earlier may be left to the judgment of the surgeon.

Adherent omentum, though comparatively rare in children, is occasionally met with, and when present, operation should be performed without delay. Reducible hydrocele or fluid in the hernial sac is more frequently seen, and this condition precludes the hope of cure by truss treatment and calls for operation.

Methods Employed.—I have already in former papers discussed the relative value of the various methods of operation for radical cure, and at present shall do little more than describe the methods personally employed in the cases reported. Time is wasted in a theoretical discussion of the relative value of the different methods of operation for the radical cure of hernia. The value of a method can neither be determined by the reputation of the surgeon who has originated it, nor by the distinction of the men who employ it. It can be settled only by a scientific analysis of results subjected to the test of time. By time I do not mean the number of years since the operation was performed, but the careful tracing of patients to final results, or for long periods of time.

The chief object of this paper is to furnish, by the presentation of a considerable number of cases operated upon by a single method and uniform technique, additional data that may be of help in solving the question of choice of methods in the radical cure of hernia. The method of Bassini, when first published, appealed to us strongly as superior mechanically to any hitherto described, and the practical results seemed to bear out the theoretical superiority.

The chief advantage to my mind is the fact that the only weak place in the wound, viz., where the cord emerges through the internal ring, is protected by the overlying layer of the external oblique aponeurosis, so that a recurrence can only take place by the hernial protrusion forcing itself directly through the aponeurosis at this point or taking a right-

angled course downward beneath the external oblique. With perfect wound healing this ought never to occur, and we find in actual practice it very seldom does. However, to correct, as far as possible, this one weak point of the operation, I have slightly modified Bassini's technique by introducing a single suture above the cord, bringing the internal oblique muscle into apposition with Poupart's ligament, thus making the cord come out between the two upper sutures. The only other change that I have adopted has been the substitution of an absorbable suture—chromicized kangaroo tendon—for the silk sutures originally employed by Bassini, and which he still uses. The advantages of the absorbable sutures I will refer to later. In introducing the deep layer of buried sutures, I place the first stitch so that it just touches the lower edge of the cord when the latter is held vertically to the plane of the abdomen. This furnishes a uniform guide as to how high up the canal the sutures should go. The sutures are introduced from within outward by a full curved Hagedorn needle without a holder, and the index-finger of the left hand, passed just beneath the muscles, guards the peritoneum from harm. Four to five sutures suffice below the cord and one above. The aponeurosis is closed also from above downward, but with a continuous suture of kangaroo tendon of fine calibre. The skin is closed with No. 1 catgut, without drainage. A dressing of 10 per cent. iodoform and moist 1 to 5000 bichloride gauze is then applied, and the wound not dressed until the seventh day. In children, a plaster-of-Paris spica is applied in addition to the usual dressing.

The technique has been given somewhat in detail for the reason that it has been uniformly employed during the entire ten years, and may have some bearing upon the wound healing.

Wound Healing.—Prior to the introduction of rubber gloves, two and one-half years ago, 96 per cent. of the cases healed by primary union. After the gloves were used by assistants and cots or gloves by myself, I had a series of

200 cases with but one suppuration, and this was due to a streptococcus infection from the skin of the patient, as shown by examination of the skin at the time of operation. I believe that these results in wound healing are in no small part due to the fact that all bruising of tissue has been carefully averted, and operations have been rapidly performed. In uncomplicated cases the average time has been ten to twenty minutes. All bleeding points have been carefully tied, and the aim has been to make the field of operation as clearly defined and as dry as a dissection on the cadaver. The buried sutures employed—kangaroo tendon and catgut—during the earlier period were sterilized by boiling in absolute alcohol under pressure; during recent years, by the Kumol method. These sutures have been subjected to frequent bacteriological tests and have always proven sterile.

Advantages of Absorbable Sutures.—The objections that have been offered from time to time to the use of absorbable buried sutures rest entirely upon the assumption that it is impossible to render such sutures perfectly sterile. That this assumption is without foundation in fact is conclusively proven not only by my own experience, but also that of Drs. Bull, De Garmo, and others, who have used these sutures for many years. It is still further proven by the frequent bacteriological tests which have invariably shown these sutures to be sterile. The ideal buried suture in operations for the radical cure of hernia is one that, while remaining unabsorbed sufficiently long to secure thorough union of the parts in apposition, becomes absorbed before it has had time to cause irritation and subsequent sinus formation. Both catgut and kangaroo tendon may be so treated with chromic acid as to remain in the tissues any desired length of time before absorption. For hernia operations, I believe that this period should not be more than three to four weeks. The disadvantages attending the use of non-absorbable buried sutures for hernia operations have already been so frequently pointed

out by Dr. Bull and myself, that I will not do more than briefly repeat these important points.

(1) Late sinus formation may, and frequently does, occur with perfect primary union at the time of operation.

(2) The usefulness of a buried suture has been fulfilled at the end of three to four weeks, after which time, if non-absorbable, it will cut through the tissues until there is no further tension, and henceforth remain as a foreign body capable of causing much annoyance, and predisposing to relapse by sinus formation and long-continued suppuration.

(3) I have personally observed cases in which non-absorbable sutures were used with sinus formation more than three years after operation, although the original wound had healed by perfect primary union.

At the Hospital for Ruptured and Crippled there have been observed more than thirty cases of sinus formation following hernia operations in which silk, silkworm-gut, and silver wire had been used for the buried sutures. The last case was a patient operated upon in January, 1900; a sinus followed operation, necessitating his remaining in the hospital until the following May. In April a portion of the wire was removed, but the wound did not heal. He left the hospital in May, and made frequent visits to an out-patient department to have the sinus dressed. It continued to discharge freely, until finally, in December, nearly a year from the time of operation, the remainder of the wire was removed and the sinus finally closed. In the meantime the rupture had recurred and become several times its original size. So much suppuration had occurred with the formation of scar tissue, that further operation is impossible, and, as the rupture cannot be controlled by a truss, the patient is practically an invalid. The great majority of the cases with slowly healing sinuses have been followed by relapse.

This list of unfortunate results following the use of non-absorbable sutures would seem sufficiently large to demonstrate the disadvantages of such sutures.

The value of Bassini's operation cannot be judged by the number of relapses that have occurred in the hands of a few surgeons, however distinguished, who have operated on but a comparatively small number of patients. In many of the relapses following the so-called Bassini operations the ideal operation could not have been performed, as proved by the short cicatrix of the wound. Perfect familiarity with the technique of the operation cannot be acquired in operating a few times. My experience with recurrent hernia at the Hospital for Ruptured and Crippled shows that a large proportion of the patients with relapses from Bassini's operation were operated upon by surgeons whose experience with the method was comparatively limited. It is an undoubted fact, as our records show, that while operations for the radical cure of hernia have been steadily and rapidly on the increase for the past ten years, the number of patients with a recurrence that present themselves at the hospital for trusses has been just as steadily on the decrease.

During the year 1891, sixty-four patients with recurrent hernia applied for treatment at the Hospital for Ruptured and Crippled, while during the past year (1900) but twenty-six applied. This shows more conclusively than anything else the vast improvement in present methods and technique over those in vogue a decade ago. This encouraging fact is still further confirmed by the paper of Delbet on "The Remote Results of the Radical Cure of Hernia." (*Bulletins et Mémoires de la Société de Chirurgie*, 1900, No. 28.) During the first six months of the year 1900, he states that in the "Service des Bandages" in Paris only seven patients with a recurrent hernia presented themselves. The author concludes that "if the enormous number of operations performed for the radical cure of hernia at the Paris Hospitals is taken into consideration, the small number of recurrent herniæ observed in institutions for the supply of trusses is a sure indication that operations for the cure of this affliction are really radical."

Cases of Unusual Interest; Hernia of the Cæcum and Sigmoid Flexure.—Thirty-two operations were for hernia of the cæcum and appendix. A large number of these were cases of sliding hernia, or “hernie par glissement,” as designated by the French authors. In these the usual peritoneal sac is imperfect, generally lacking in its posterior aspect. This condition, while much more common in the cæcum, I have occasionally observed in hernia of the sigmoid flexure. The difficulty of operating upon this class of slipped or sliding hernia of the cæcum and sigmoid has been recently pointed out by Dr. Weir. Clinically, this condition can be frequently diagnosticated by the fact that attempts to replace the protruding bowel into the abdominal cavity accomplish little. While a certain portion may be reduced, a small portion is always left behind, and this can usually be differentiated from adherent omentum.

In a number of cases observed at the Hospital for Ruptured and Crippled, the diagnosis was made before operation by this method. According to Dr. Weir, the sliding herniæ are more frequent in the left side of males and in middle and advanced life. The usual history prior to operation is that of a hernia, at first reducible, but not always easy to control with a truss. This condition soon passes into one of permanent irreducibility.

Our own experience does not confirm the opinion of Dr. Weir, that the sliding herniæ are more common on the left than on the right side, nor do we believe that they are more common in males in middle or advanced life. In fact, very few statistics upon operations for hernia in children, with sufficiently full details for comparison, are available. An analysis of 795 cases of hernia in children operated upon at the Hospital for Ruptured and Crippled shows a comparatively large number of cæcal herniæ, many of which were of the variety described by Dr. Weir. My personal statistics show a greater proportion of sliding hernia in children than in adults; and I believe that when statistics are sufficiently complete

to make a fair comparison possible, we shall find this to be true in general.

The operative treatment of this form of hernia is by no means easy. Dr. Weir states that in his earlier cases he attempted to push up the bowel towards the external ring, and to hold it there by sutures carried from below the intestine to the side of the ring or through the abdominal wall. This operation proved a failure. In two more recent cases, he separated the bowel from its posterior attachments, and then made a flap of the peritoneal portion of the sac, which was turned backward and sutured behind the gut as far as practicable. These two cases were well eight months after operation.

In my own cases I have followed the plan of separating the cæcum and bowel sufficiently high up to permit of complete reduction. The peritoneal openings are then sutured with catgut and the abdominal wound is closed in three layers, as in Bassini's operation, without transplantation of the cord. In two cases only has relapse occurred.

Inguinal Hernia associated with Undescended Testis.—

I have operated upon thirty cases of undescended or partially descended testis associated with hernia. Fourteen of these were between ten and fourteen years. The testis was not removed in a single case, and I believe that in practically all cases of undescended testis associated with hernia in which operation is indicated, it will be found possible to bring the testis outside of the external ring. The canal can then be closed by Bassini's method, or by allowing the cord to come out of the lower angle of the wound, without transplantation. This latter method permits the testis to be brought down one-half to three-fourths of an inch lower than when the cord is transplanted. In most of these cases the testis was somewhat smaller than that on the opposite side. In some of my earlier cases operated upon between 1891 and 1895 I attempted to keep the testis down by anchoring it in the scrotum, either to the scrotum or to a wire frame outside

of the scrotum. In most of these cases the testis retracted to a position just outside the external ring, and as there seemed to be very little gained by the various methods of anchoring, they were soon given up. With one exception all of my cases were operated upon by Bassini's method. The results, as far as the cure of the hernia is concerned, have been perfect in every instance. I believe that operation is rarely indicated as a routine measure before the age of ten to twelve years, for the reason that in many cases the testis descends into the scrotum or below the external ring about the age of puberty. The accompanying rupture is usually small, has little tendency to become strangulated, and may be easily retained by a light spring truss, the pad of which rests above the testis.

Inguinoperineal Hernia associated with Maldevelopment of the Testis.—I have observed six cases of testis in the perineum, and in four of these there was an accompanying well developed hernia, the latter following the course of the testis and appearing in the perineum rather than the scrotum. In one of these cases, already reported, in which the hernia was the size of a cocoanut and the testis very small and ill developed, the testis together with the entire pouch were removed and the canal closed in three layers. The patient remained well for about three years, when death resulted from drowning. In the other three cases the testis was apparently fully developed, and I was able to preserve a sufficient amount of peritoneum to make a perfect tunica vaginalis. I then formed a new pouch with the finger in the hitherto empty scrotum, into which the testis and its new tunica were transplanted. The patients all made an excellent recovery, and have with one exception remained free from recurrence up to the present time, one to three years after operation.

Properitoneal or Interstitial Hernia.—Four cases were of the interstitial or properitoneal variety of hernia. Interstitial hernia is generally associated with undescended testis. Of forty-two cases of interstitial hernia collected by Langdon,

there were only two instances in which the testes were normally developed in the scrotum. The position of the testis varied between wide limits. In two cases it was high up in the scrotum; in two others just outside the external ring; in twenty-six it was situated in the canal. The relative frequency of interstitial hernia as estimated by Langdon is 1 in 1100 cases. Of my own cases the one most worthy of note was a properitoneal Richter's hernia, occurring in a boy aged fifteen years. Operation was performed about fifteen hours after strangulation. A loop of small intestine was found tightly constricted by the neck of the sac at the internal ring, including about seven-eighths of the lumen of the bowel. The patient made an excellent recovery.

Radical Cure of Inguinal Hernia in the Female.—Up to the present time I have operated upon 155 cases of inguinal hernia in the female, without a relapse. The method employed I have recently described in detail (*ANNALS OF SURGERY*, December, 1900), and will merely say that the technique is practically the same as in the operation for inguinal hernia in the male, with the exception that the round ligament, after having been carefully dissected from the sac, is allowed to drop back into the lower angle of the wound. The canal is closed in two layers, precisely the same as in the male. The round ligament as it approaches the pubic bone occupies so little space that it requires a much smaller opening than the cord in the male; and my own results would seem to show that there is no necessity for transplanting it, as has been advocated by Kelly and others. The dissection of the sac from the round ligament, while somewhat more difficult than the dissection of the sac from the cord in the male, can, I believe, always be accomplished with comparative ease, and therefore I do not think that the excision of the round ligament with the sac, as advocated by Championnière, is ever called for. The neck of the sac can always be easily reached, and the ligature or suture placed well beyond it, where it widens out into the general peritoneal cavity, both in the

male and the female, without cutting the internal oblique muscle. The cutting of the internal oblique greatly weakens the canal, I am convinced, and increases the chances of relapse.

Up to the present time but few statistics are available bearing upon the relative results of the various methods for the cure of inguinal hernia in the female. Among the 459 cases of hernia operated upon at the Johns Hopkins Hospital, and reported by Bloodgood, only thirty-nine were of this variety. The round ligament was excised in twenty cases, and the internal oblique muscle divided and transplanted. In six cases the ligament was excised, but the internal oblique not divided. In three the round ligament was not disturbed, but the internal oblique was divided and transplanted. In five cases the round ligament was left undisturbed and the internal oblique not divided. Perfect results were noted in twenty-one cases, in six of which the patient had remained well from three to eight years. In one case there was a recurrence. Championnière has recently reported seventy cases, with three relapses.

The ages of my patients ranged between four and seventy years. The average time they were confined to bed was ten days. Most of them were allowed to go home at the end of two weeks. All except thirteen of the patients have been traced, and not a single relapse has been observed.

Femoral Hernia.—Although a large number of methods for the radical cure of femoral hernia have been proposed from time to time, it has been impossible to judge of their relative value except on theoretical grounds, for the reason that, with the single exception of Bassini's statistics for femoral hernia, very few cases have been reported and traced for any length of time. Bassini published a series of fifty-four cases operated upon by his own method, with no mortality and without a single relapse in forty-one cases traced from one to nine years. Although Bacon, in his recent paper (*Yale Medical Journal*, January, 1901), attempts to show that Bassini's method

is mechanically defective, these practical results go far towards outweighing any theoretical shortcomings. Personally, I have operated upon fifty-four cases of femoral hernia during the past nine years, and thus far but one relapse has been observed. Sixteen of these cases were operated upon by Bassini's method, all the others by the so-called purse-string method, originally proposed, I believe, by Cushing, of Boston.

The technique in brief is first to thoroughly free the sac well beyond the neck; high ligation of the sac, and closure of the canal by means of a purse-string suture of chromicized kangaroo tendon. The suture is introduced through Poupart's ligament or the inner portion of the roof of the canal, or crural arch, from where it passes downward into the pectineal muscle or floor of the canal, outward through the fascia lata overlying the femoral vein, and upward through Poupart's ligament or roof of the canal, emerging about three-fourths of an inch from the point of introduction. On tying the suture, the floor of the canal is brought into apposition with the roof and the femoral opening is completely obliterated. The superficial fascia may then be closed with catgut or fine tendon, and the skin either with catgut or silk. This method of closing the femoral canal is much simpler than Bassini's, and, from the results obtained, I am inclined to give it the preference, except possibly in hernia with a very large opening. In thirty-eight cases operated upon by this method, no relapse has been observed. The only recurrence that took place in the fifty-four cases occurred in a case operated upon by Bassini's method, a woman, thirty-five years of age, with femoral hernia the size of an egg. Operation was performed in March, 1896. Curiously enough, this is the only case of femoral hernia in which suppuration occurred, which delayed the wound healing four weeks. A very slight relapse took place one and one-half years later. I personally examined the patient two weeks ago, five years after operation, and, although she does not wear a truss,

scarcely more than an exaggerated impulse could be detected.

In all operations for femoral hernia, I believe it to be most important to thoroughly free the canal from all extra-peritoneal fat. As regards the period of convalescence, I have kept patients in the hospital for a little shorter time than in inguinal hernia, allowing them to sit up on the tenth day, and to go home at the end of the twelfth to fourteenth day. No truss has been worn after operation in any case.

A Study of Relapsed Cases.—An analysis of the relapsed cases in my series is of interest, inasmuch as in nearly every instance a sufficient cause for the relapse can be found. Of 776 cases of inguinal hernia operated upon by Bassini's method, with kangaroo tendon for the buried sutures, six relapses have been observed. These occurred in the following cases:

CASE I.—Male, aged thirty-five years, with large inguinoperineal hernia. Operation was performed on July 9, 1896. The testis was preserved, but was not transplanted into the scrotum, as in two later cases of hernia of this variety. The wound was closed by Bassini's method and healed by primary union. The patient was very stout and had much adipose tissue. In addition, he was a butcher, and resumed work, doing heavy lifting, immediately after leaving the hospital. The hernia recurred ten months later, being the size of a pigeon's egg.

CASE II.—Male, aged twenty-seven years, with large, irreducible omental scrotal hernia of eight years' duration. Operation was performed July 1, 1897, Bassini's method being employed. The wound healed by primary union. Twenty months after operation there was a slight weakness in the canal, and a truss was advised, though the rupture had never come down, and one might well hesitate to call it a relapse.

CASE III.—Male, aged twenty-five years, with large scrotal, right inguinal hernia, was operated upon in the fall of 1894 by Bassini's method. He remained perfectly well, doing heavy lifting without support, and was in a cavalry regiment in the Cuban war, doing hard riding. He contracted typhoid fever, and during the illness resulting his weight fell from 140 to 89 pounds. Shortly after convalescence, before he had regained his lost weight, when attempting to head a barrel weighing five hundred pounds, he felt something give way in the old cicatrix, and shortly afterwards noticed a small bulging. Examination the following year showed a slight recurrence in the region of the internal ring. I reoperated upon him in April, 1901, and a description of the condition found will be given later.

CASE IV.—P. M., male, aged twenty years, was operated upon in 1893 for a right inguinal hernia. The wound healed by primary union, and he remained well until two years later, when he received a severe kick in the groin during a fight. A very slight relapse occurred in the canal at the site of the internal ring. A truss was applied, and little more than an exaggerated impulse has been noted since.

CASE V.—O. S., male, aged twenty-three years; operated upon September 7, 1898, for a large, reducible inguinal hernia. Severe staphylococcus suppuration extending to the deeper layers occurred. The patient remained well until one and one-half years later, when, on lifting a barrel of potatoes, he felt something give way, and a small protrusion was observed in the canal.

CASE VI.—J. W., male, aged eighteen years. Operation was done in 1893 for a right inguinal hernia. The patient remained well for six years, at the end of which time a slight weakness was observed in the canal, and a truss applied.

In addition to these six cases, there has been one other relapse in a case operated upon by the house surgeon in my service at the Post-Graduate Hospital in 1896. The patient was a boy, four years of age. Very severe and prolonged, deep suppuration followed operation, and the wound was four months in healing. Relapse occurred six months after operation.

In still another case relapse occurred in which Bassini's operation with a different technique was employed. This was the first time I attempted to perform Bassini's method in 1891, and the operation was very imperfectly done. Silk was used for the buried sutures, the hernia was very large, and the operation prolonged. Deep suppuration followed with extrusion of nearly all the buried sutures. Relapse followed three months afterwards.

Eliminating the last two cases, inasmuch as they do not properly belong to the main series of cases operated upon by uniform technique, with buried absorbable sutures, we have but six relapses in 773 operations by Bassini's method. Much time and effort have been spent in tracing these cases to final results.

Eighteen cases of inguinal hernia in the male were operated upon without transplantation of the cord. These were

nearly all early cases, operated upon between the years 1891-1893. In six of these cases relapse followed. It is to be noted, however, that in two of these cases the hernia was of the cæcal variety.

Direct Hernia.—I have operated upon eleven direct herniæ in seven individuals, in four cases the hernia being double. Bassini's method was employed in all except one, and in this the cord was not transplanted.

Relapsed Cases cured by Second Operation.—The following cases have some bearing upon the question of operating upon cases that have once relapsed.

CASE I.—V. S., aged nine years. Operation by Czerny's method, with silk, January, 1892. The wound healed by primary union, but in a few weeks a small sinus formed and some of the silk sutures came out. The hernia relapsed in about four months. I again operated by Bassini's method, in July, 1892, using kangaroo tendon for the buried sutures. The patient is at present free from recurrence, nearly nine years later.

CASE II.—F. H., aged ten years, was operated upon February 10, 1892, by Czerny's method, with chromicized catgut for the buried sutures. The hernia relapsed in three years. In July, 1895, I again operated, this time by Bassini's method, with kangaroo tendon for the buried sutures, and the hernia was perfectly sound in October, 1900, more than five years later.

CASE III.—A. B., male, aged twelve years. He had been operated upon by Dr. Bull, by Czerny's method, with non-chromicized catgut, for a double inguinal hernia, February 4, 1889. The hernia relapsed on both sides within two months after operation. On April 11, 1893, I operated on both sides, by Bassini's method, with kangaroo-tendon sutures. The patient was perfectly sound when last observed, April 22, 1899, or six years after the secondary operation.

CASE IV.—W. Y. S., aged forty years, with double inguinal hernia. This case is of very great interest, inasmuch as the operations were performed in August, 1891, nearly ten years ago. I used Bassini's method on the right side and Czerny's method on the left. Both sides remained firm until the fall of 1900, or nine years after operation, when the left side recurred in the canal. I operated for the recurrence one week ago, this time by Bassini's method. The right side remains perfectly sound.

I have operated upon a number of other patients for relapse following other methods of operation, but the cases are more recent, and hence of less interest. The only operation for relapse following Bassini's method that I have performed was done a week ago, upon the patient operated upon seven

years ago, and in whom the relapse was due to heavy lifting after enormous loss of weight from an attack of typhoid fever. In this case I found the union of the aponeurosis absolutely firm; the recurrence had taken place at the internal ring, and consisted merely of a dilatation of the space left for the cord to emerge. There was no sac, but a bulging of the peritoneum into the space referred to, and dissecting off for a small area the aponeurosis from the underlying internal oblique muscle. The cord was rather adherent to the aponeurosis and oblique muscle, but was separated, and Bassini's operation was again performed, leaving a normal opening for the cord at the internal ring.

Mortality.—There have been two deaths in the series of 845 operations, one of these was the death referred to in a child from ether pneumonia, and the second occurred in an adult with large irreducible omental hernia. The omentum was returned to the abdomen, and the patient developed intestinal obstruction on the sixth day. A second operation was performed; no evidence of peritonitis could be found, and death was thought to be most probably caused by volvulus.

The superiority of Bassini's method is further confirmed by the splendid results obtained at the clinic of Professor Carlé as reported by Galeazzi ("Risultati definitive nella cura operativa dell'ernia inguinale," by Galeazzi. *Estratto della Clin. Chir.*, 1899, No. 6).

During the ten years between 1889 and 1899, 1400 operations for the radical cure of hernia were performed at the clinic upon 1285 patients, with but two deaths, and one of these occurred as a result of pneumonia on the seventh day after operation. Bassini's method was employed in 1120 of these 1400 operations; Kocher's in the remaining 280. Efforts were made to trace the cases, and it was ascertained that in 840, in which upwards of two years had passed between operation and examination, 792, or 94.29 per cent., remained perfectly sound, while forty-eight, or 5.71 per cent., showed a recurrence.

Galeazzi collected a further series of 1334 cases of hernia

operated upon according to Bassini by surgeons outside of Italy, which showed but 2.16 per cent. of relapses.

The importance of primary wound healing in effecting a permanent cure is well illustrated by the cases observed at Carlé's clinic. Of 128 cases of secondary wound healing, ten, or 7.9 per cent., relapsed; and of these relapse occurred during the first year in seven; during the second year in two, and after two years in but one, thus demonstrating that relapse is far more likely to occur during the first year after operation than later.

In eighty-four cases of voluminous hernia, Galeazzi states, there were but two relapses. At the same time, he points out the danger of operating upon very large, irreducible herniæ.

Galeazzi considers Bassini's method more logical, more surgical, and more secure than Kocher's, and believes that the superiority of the method is especially shown in cases in which the canal is not straight, since the obliquity of the canal favors its closure at the moment when the intra-abdominal pressure is exerted or increased, and to this fact he ascribes the excellent results that have been obtained by Bassini's method.

De Garmo, of New York, has operated 612 times by the Bassini method with but eight relapses. The very large statistics of Dr. Bull, though not published up to date, still further confirm the superiority of this method.

Personal Results.—During the period from August, 1891, to May, 1901, I have operated upon 845 cases of inguinal and femoral hernia. Of these 791 were operations for inguinal hernia, 773 of which were operated upon by Bassini's method, with the substitution of silk by kangaroo tendon for the buried sutures. Fifty-four were operations for femoral hernia, with but one relapse.

Five hundred cases of inguinal hernia were traced from one to nine years, with six relapses. Of 155 cases of inguinal herniæ in the female, eighty-four were traced from one to eight years after operation, without a single relapse.

Of the fifty-four cases of femoral hernia, thirty-one were well from one to nine years after operation.

Of the inguinal hernia operated upon by Bassini's method, ten were well from eight to nine years after operation; thirteen were well from seven to eight years after operation; twenty-five were well from six to seven years after operation; twenty-eight were well from five to six years after operation; fifty-four were well from four to five years after operation; eighty-nine were well from three to four years after operation; 104 were well from two to three years after operation; 172 were well from one to two years after operation.

TWO CASES OF LIGATION OF THE EXTERNAL
CAROTID FOR SEVERE HÆMORRHAGE,—
ONE AFTER TONSILLOTOMY, THE OTHER
AFTER A SLIGHT INTRANASAL OPERATION.¹

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THE following two cases are of sufficient rarity to make it desirable to record them. Persistent hæmorrhage from the tonsil or the posterior nasal cavity, while infrequent, is a cause for the greatest anxiety when it does occur.

I do not wish to advocate indiscriminate ligation of the carotid, but, in view of its effectiveness and of the slight danger which attends modern operations, I would urge that it be resorted to more frequently and not postponed too long. The prompt recovery of both of these and other patients similarly treated warrants a relatively early operation. Of course, when I say ligation of the carotid, I mean the external carotid. It is a perfectly easy operation, requires but a few minutes, and is followed by no evil consequences. To ligate the common carotid when the bleeding vessel is a branch of the external carotid is an inexcusable surgical blunder. Not infrequently the cutting off of the circulation from the brain through the internal carotid has resulted in cerebral softening and death.

Another encouraging feature of the operation in both cases was that the operation wound did not bleed. The natural fear that renewed uncontrollable bleeding might attend the new wound may have deterred surgeons in the past from re-

¹ Read before the Philadelphia Academy of Surgery, May 5, 1901.

sorting to the operation, but this fear is not generally realized, and should be cast aside.

CASE I.—Ligation of External Carotid for Hæmorrhage after Tonsillotomy.—Mr. L. B. R., aged twenty-three years, had long suffered from a greatly enlarged left tonsil, which Dr. Walter J. Freeman removed on November 6, 1897, by a tonsillotome between 9 and 10 A.M. No special hæmorrhage occurred at the time of operation, but the bleeding did not cease. Dr. Freeman applied cold and, later, hot water, pressure, packing, styptics, etc., and all in vain. I was called to see him at 3.30 P.M. At this time Dr. Freeman estimated that the patient had lost not less than three pints of blood. He was very blanched and faint. We decided at once on ligation of the external carotid, which was done as soon as he could be taken to my hospital.

He made an uninterrupted recovery, the highest temperature being 100.6° F. the day after the operation. The hæmorrhage ceased immediately upon ligation of the vessel, and he left the hospital nine days after the operation, having remained there that length of time in order to regain his strength.

CASE II.—Ligation of External Carotid for Severe Hæmorrhage following an Intranasal Operation.—Mr. Van D. was first seen by me at the request of Drs. B. A. Randall and Walter J. Freeman on February 12, 1901, at 4.30 P.M. Dr. Randall has very kindly furnished me with the following detailed earlier history, showing the necessity for the operation, which is so instructive that I give it in full.

"I first saw the patient on January 24, finding a postnasal catarrh with marked grayish hypertrophies on both sides of the septum, decided that mild measures would prove insufficient for his relief. The anterior nares were rather unduly free, as if by shrinking after previous hypertrophy; the accessory sinuses seemed unaffected; the sphenoids being readily probed, and the trouble apparently limited to the septal cushions. These half-filled the choanæ and overlapped the back edge of the septum in a heart-shaped mass, larger on the right. History of polyp removal four years before made snaring of the posterior turbinal ends seem the real operation. There had been sharp primary but no secondary hæmorrhage at that time, and the proposal to curette the hypertrophies was promptly accepted. This was done with a sharp curette under aseptic precautions, making from the front one firm sweep on each side from the back of the septum forward one inch. There was not more than a drachm of bleeding from each side. Cocaine had been very sparingly mopped upon the surfaces attacked.

"He returned two days later with good retraction on the left side; but on the right the lower part only of the cushion was smaller, while the large upper portion was little reduced. It was therefore again curetted at the higher point, and the instrument seemed to grate along the peristemeum. The bleeding was again slight. He was to return on the 28th, but did not come in; was pressed with work at the office till rather late; felt stuffy and headachy, so he took a short Turkish bath and hurriedly dressed

and dined, then took a lady to the theatre. Towards the close of an exciting play he was attacked by sharp hæmorrhage, and had to summon medical aid, as it proved uncontrollable.

"I was called just after midnight, and found him with the bleeding nearly controlled, thanks to the firm anterior packing of both nostrils which had been done by two practitioners who had been earlier called. He had lost not less than twenty ounces, and more than an hour had been spent in the efforts to stop it, before I could help him to a cab and place him in bed in the Polyclinic Hospital. There was then a firm, dark clot filling the posterior nares, around which traces of blood still oozed, and both anterior nares, and even far back on the right, were tightly packed with sterile gauze. Bleeding recurred several times during the night, requiring the replacing of the packing; a spray of hydrogen dioxide seemed very helpful in controlling the flow. In the morning there was quiet; but sharp bleeding recurred during the day, incompletely controlled by packing and dioxide only after an hour. I removed the packing and worked back with adrenal glycerole until the bleeding points were definitely located at the curetted areas on each side of the septum, and these were lightly seared with 25 per cent. trichloroacetic acid. All clot was removed and a clean, bloodless tract found. Slight recurrence of hæmorrhage in the evening called for renewed but superficial searing with the trichloroacetic acid.

"All seemed secure on the 30th, and I told him he could leave the hospital, but a trace of bleeding when he packed his bag led him to remain that evening. He came next day to my office showing no signs of oozing, and was dismissed to his boarding-house, but warned that care must be exercised in a couple of days, when the eschars would be loosening. I was summoned in haste that evening to find him again bleeding severely from the *right* side, but with free flow into the throat and from the left nostril when impeded on the right. Not until a firm postnasal plug was introduced could full cessation be secured. That left naris was also packed from the front, as he felt insecure without it, and he was taken back to the hospital. I was recalled to him at midnight, and stayed by him during the night, although there was but slight oozing at intervals.

"February 1 was almost undisturbed; but on the 2d bleeding recurred, and after brief control baffled all efforts at its complete control. Dr. Freeman saw him in consultation, and emulsion of adrenal, melted gelatin, and other styptics were injected from back and front without avail. Dr. Agnew's recommendation of a tampon of ham-fat was then adopted, and it was introduced from the front until its end protruded from the choana, and its anterior end was secured by a ligature and supported by a small gauze tampon. Little oozing was noticed during the evening, but when an enema was given at ten o'clock he vomited some ten ounces of blackish blood, and his following stools were tarry. All seemed quiet on the 3d, and Dr. Kyle, who had once treated him, saw him in consultation, but thought the plugging too efficient to be disturbed for study. Opium and lead acetate were substituted for the calcium chloride which he had been taking. Little portions of dark clot came away at times on

the 3d and 4th, and tenacious mucus worked out along the plug front and back, but there was no fresh bleeding. On the 5th the plug was quite offensive, and so loose that it seemed best to remove it after gentle spray with Dobell's solution. A linear adhesion was apparently torn loose, and bleeding recurred as vigorously as at any previous time. Dr. Kyle was summoned, as he had asked to see it if again bleeding; but no measures availed to more than lessen the flow until the galvano-cautery was lightly applied to the curetted area, when immediate control was gained. A ham-fat plug was replaced, but too tightly, causing crushing of it in pressing it back, and it disintegrated, especially on the second day, and permitted fresh hæmorrhage. A better plug was introduced after renewed cauterization and, with careful cleansing and use of aristol, was retained until the 10th, when brief bleeding recurred frequently during the day and twice sharply in the night. On the 11th Dr. Freeman saw him again in consultation, and advised that the external carotid be tied, as he felt that his condition was growing critical and that local measures had been tried to the full. Dr. Keen was called in on the 12th, and, concurring in this advice, tied the external carotid that afternoon. The nasal plug was at once removed without hæmorrhage, the nasal passages thoroughly cleansed and dusted with aristol, and no further bleeding has since taken place, except that some crusting at the anterior nares caused at times trifling excoriations, and a drop or two of blood oozed at these points. The patient left the hospital in two weeks after primary closure of the cervical wound. Pulsation in the vessel above the ligature was very uncertain until the eighteenth day, when it became positive and fairly strong."

Dr. Randall estimated that he had lost probably ten pints of blood in all. So much blood had been swallowed that the stools were tarry. When I first saw him his pulse was weak, his face blanched, and it seemed pretty clear that he would soon succumb if the bleeding was not stopped. I therefore concurred in the judgment of Drs. Randall and Freeman that immediate ligation of the external carotid was indicated. This was carried out an hour later, the artery being tied with silk without any difficulty. The wound through which the artery was reached did not show any tendency to bleed, and no ligature was required. While I was ligating the external carotid, Dr. Stern gave the patient a quart of saline solution by hypodermoclysis.

He made an uninterrupted recovery. His highest temperature only once went above 99.4° F., and he left the hospital on February 27, fifteen days after the operation. On February 18, six days after the operation, about a drachm of blood was lost, but from the *left* nostril near the vestibule, where a crust had been torn away. There was occasionally a little oozing from the left nostril, probably from superficial excoriation, but no bleeding whatever on the right side, and that on the left was very insignificant. Fifteen days after the operation, pulsation had not returned in the artery, but three days later there was a slight but distinct pulsation perceptible.

THE OPERATIVE TREATMENT FOR EXSTROPHY OF THE BLADDER.¹

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ALTHOUGH surgery records a vast expenditure of ingenuity and perseverance in the attempt to cure this anomaly, its success in the restoration of the function of the bladder remains practically *nil*. Previous to 1850, the only attempts made were those in which mechanical devices predominated. Their object was to protect the sensitive bleeding mucous membrane and to catch and retain the urine.

The first well-defined operative procedures were inaugurated by Roux (1852), and subsequently modified and practised by Nélaton,¹ Pancoast,² Ayres,³ Dolbeau,⁴ Le Fort,⁵ Wood,⁶ and Billroth.⁷

The essential feature of these procedures was the superimposition of epidermal flaps.

A large quadrilateral flap with its base attached beyond the upper margin of the bladder was turned downward and over the exstrophied mucous membrane. Its epidermal surface faced the vesical cavity, and its margins were sutured to the vivified edges of the bladder.

In Nélaton's method, this flap was covered by another taken from the scrotum.

In Wood's case by two lateral flaps taken from the lateral aspects of the abdominal wall; and in Billroth's case by a single flap obtained from the left side of the abdomen close to Poupart's ligament.⁸

¹ Read before the New York Surgical Society, March 27, 1901.

To secure a better closure of the epispadias and to avoid the marginal gangrene of the flaps used in closing the exstrophy, this method was again subjected to slight modifications by Holmes,⁹ Bigelow,¹⁰ Levis,¹¹ Parker,¹² Smith,¹³ Poisson,¹⁴ and as late as 1896 by Pozzi.¹⁵

As these various modifications were repeated, it was noted that the continued growth of hair, the exfoliation of the epidermis, and the formation of pockets in the newly-made bladder frequently gave rise to the formation of calculi and to repeated attacks of cystitis. In 1875, Thiersch¹⁶ and Hirschberg,¹⁷ believing that the normal urine would not act unfavorably upon either fresh or granulating surfaces, recommended new procedures. The former suggested a method consisting of two lateral flaps, covering respectively the lower and upper halves of the exposed bladder. The flap destined to cover the lower half was bounded internally by an incision closely circumscribing the attached lateral margin of the bladder and extending as far as the root of the penis; externally, by an incision parallel to the internal and ending just above Poupart's ligament. Above and below, this flap remained attached; between these points the flap was separated from the aponeurosis of the rectus and external oblique muscles and allowed to granulate. After a period of three weeks its upper attachment was severed, twisted inward, and sutured to the freshened margins of the bladder and abdominal wall, but not to the mucous membrane of the urethra. Fourteen days later, if the epispadias had been already corrected, the union between the urethra and lower margin of the flap was made. The second abdominal flap, destined to cover the upper half of the exposed bladder, was prepared upon the opposite side in much the same manner. After a period of three weeks its upper attachment was divided, and the flap, turned so as to cover the remaining upper portion of the bladder wall, was sutured in position. Up to this time the urine had escaped through the space now covered by the second abdominal flap. After this union, the urine passed by the urethra. According to Thiersch's own statement, the actual time required was

seven months, and if we add the time required to remedy one or more failures, we can safely say one year.

Hirschberg, not believing it necessary to wait for granulation to appear in the flap, either on account of infection (provided the urine was acid) or on account of its nutrition, transplanted a large abdominal flap, covering at once the exposed bladder. Hirschberg in this case, which some have claimed was an epispadias, laid stress upon the importance of readjusting the sphincter vesicæ, and thought he had partially attained it. In spite of this recommendation, stones continued to form and repeated attacks of cystitis occurred.

In 1881, Sonnenberg,¹⁸ aware of the unfavorable results of these autoplasmic methods, and believing that a favorable outlook for a safe communication between the intestine and the ureters had not been shown in the work of Simon,¹⁹ Holmes,²⁰ or Smith,²¹ advocated a complete extirpation of the bladder and a union of the ureters and the urethral mucous membrane. After this was accomplished, the urethra was to be closed by Thiersch's method and a urinal applied.²²

In 1884, Niehans,²³ and in 1886 Van Itersen,²⁴ each operated upon a case by the Sonnenberg method with success. In 1887, Zesas,²⁵ referring to these cases, strongly advocated the method in extensive varieties of this anomaly, but leaves the question an open one for minor degrees of the deformity.

In 1889, Segond,²⁶ with the idea of making a small bladder into which the urine would first empty, modified Sonnenberg's operation by retaining enough of the mucous membrane of the bladder to cover the ureters and to close in the epispadias. This accomplished, the rest of the bladder was removed, and the space in the abdominal wall was closed by two lateral flaps, while the penis was covered from the redundant prepuce. Duplay²⁷ further improved the method by closing the epispadias before extirpating the bladder. In 1895, Poisson and Piéchaud²⁸ both operated unsuccessfully by the Segond method.

In 1879, Billroth, in spite of the previous failures of Gerdy²⁹ and Hirschberg (1873), attempted to restore the

bladder by first uniting the margins of its mucous membrane, and subsequently the edges of the abdominal wall.³⁰ It remained, however, for Czerny in 1884³¹ to make the first well-planned attempt to free and unite by suture the margins of the bladder wall. In this method, the bladder was freely loosened from all its attachments until it remained adherent at its base only, over an area large enough to include the ureters. The bladder wall was then sutured, and the space was covered by two lateral pedunculated abdominal flaps. In a second or third operation, the urethra and the vesical orifice were united exactly with the intention of producing an elastic closure of the bladder. Czerny believed that this elastic closure, by withstanding a certain amount of urine before it was overcome, would gradually lead to the development of a sphincter muscle. No such sphincter developed in Czerny's case during the following two years, and after five years the same condition was reported to be present. This method was repeated by Dohren,³² Adams,³³ Smith,³⁴ Wyman,³⁵ and, finally, by Neudorfer,³⁶ who modified previous methods by making a horse-shoe incision surrounding each side of the bladder in such manner that the two ends corresponded to its vertex and neck. This incision, which was carried as deep as the transversalis fascia, allowed an approximation of the margins of the bladder wall. The bladder was now freed for a distance of one centimetre from its edges and an accurate suture applied. In the same manner the abdominal wall was sutured over the line of union in the bladder.

In these attempts to construct a bladder lined entirely with a mucous membrane, the aim in completing the union of the bladder and of the urethra was only directed towards establishing an elastic constriction, which would withstand the escape of urine from the bladder for a longer or shorter time.

As early as 1855, Demme³⁷ attempted, by a mechanical device exerting pressure upon the front and sides of the pelvis to appose the pubic bones, to make a spacious bladder, and possibly to establish sphincteric muscular power. The time,

the patience, and the constant care required in this preliminary step, and the failures to establish muscular power at the neck of the bladder, recorded by both Wood and Hirschberg, rendered further attempts unpopular until Demme's method was revised and modified by Trendelenburg³⁸ and Passavant.³⁹

Trendelenburg proposed to reduce the separation of the tissues at the symphysis pubis by means of an osteotomy at the sacro-iliac articulation and continued pressure upon the sides and front of the pelvis by a specially constructed pelvic girdle.⁴⁰ Up to the fifth or sixth year of life, Trendelenburg believed that this separation could be practically abolished in four or six weeks' time (usually it required three or four months). Passavant⁴¹ proposed to accomplish the same apposition by mechanical means alone.

After the approximation was attained by either method, the margins of the bladder and urethra were freed and sutured at one operation. It was the belief then that the muscles and nerves of the bladder not being touched, the sphincter vesicæ would begin to act as soon as the union was accomplished. In no case, however, was a primary union of the bladder wall obtained, nor in the eleven cases operated upon by Makins,⁴² Heidenreich,⁴³ Küster,⁴⁴ Rydygier,⁴⁵ and by Trendelenburg was there but one continent bladder.

The extensive operative procedure, the constant danger of infecting the osteotomy wound, and the resulting deformity to the pelvis, especially in females, soon led others to devise new methods for attaining the same object.

In 1891, Rydygier, Schlange (*Ibid.*), and Hoeftmann (*Ibid.*) recommended that the incisions liberating the bladder extend to the transversalis fascia, along the outer borders of the recti muscles, and include the attachments of these muscles alone or with a portion of the horizontal ramus of the os pubis (three centimetres by one centimetre). These flaps together with the bone were then transposed so as to fill the interpubic space. In some instances (Rydygier) the freshly united urethra was placed behind and beneath the newly made arch of the pelvis.

In essentially the same manner Mikulicz⁴⁶ operated successfully upon seven cases. The immediate and ultimate results of these methods represented by Mikulicz, Schlange, and Rydygier were quite the same as those of Trendelenburg's operation, excepting the single case where a continent bladder was obtained.

The many unfavorable results of the intestinal implantation of the ureters in animals,⁴⁷ and the equally imperfect results upon man,⁴⁸ deterred many surgeons from any attempts at intestinal implantation of the ureters until Maydl, in 1892-1893, following Tuffier's suggestion "to implant the ureter with its sphincter intact," operated upon two patients, making a uretero-intestinal anastomosis by suturing to the S. Romanum an elliptical portion of the base of the bladder containing the ureters. Both patients recovered. The urine remained normal, and was retained by the rectum for three hours at a time during the day and for five or six hours at night.⁴⁹

Rein⁵⁰ and Duplay⁵¹ at about the same time operated unsuccessfully upon three cases, making a direct implantation of the ureters into the S. Romanum.

In 1895, Poppert,⁵² believing that the danger of an ascending ureteritis in uretero-intestinal anastomosis was always present and that a normally functioning bladder was still unknown, attempted to make a bladder with active sphincteric closure. In his opinion, the continent bladders reported by Hirschberg, Trendelenburg, and others had become gradually incontinent owing to the intra-abdominal pressure and the lateral traction of the mobile pelvic girdle upon the newly made vesical orifice. He therefore transferred the vesical orifice to the inferior wall of the bladder, away from all pressure or traction. By far the most important step in his operation was the closure of the epispadias and the formation of the sphincter vesicæ. This was accomplished by making two lateral incisions parallel to the mucous membrane of the urethra and deep enough to give a broad apposition of tissue over a 13 or 14 F. catheter. At the vesical

end these incisions were carried along the inferior wall of the bladder for a distance of one and one-half to two centimetres. When union took place, the bladder was to be closed by either Mikulicz's, Czerny's, or Trendelenburg's method.

It is most unfortunate that only one such operation is recorded, for in this case it was claimed that the urine could be held for three to four hours, after which it could be passed at pleasure. The capacity of the bladder was said to be 150 centimetres. In this same year König⁵³ recommended a procedure which resembled that of Mikulicz in the character of the incisions, but differed from it in that the horizontal and descending rami of the pubic bones were divided and displaced towards the median line, completely filling the interpubic space. The closure of the bladder and urethra was immediately carried out. Both cases operated upon by König unfortunately died,—one from an accidental infectious peritonitis, the other from a pneumonia following prolonged narcosis. At the same meeting of the German surgeons, Küster said that in his experience both the operations of Trendelenburg and König were too dangerous, and that he had since 1893 used a method which was based upon Passavant's dissections of two cases of epispadias with exstrophy of the bladder.⁵⁴

After making two lateral incisions parallel to the mucous membrane of the urethra and sufficiently deep to obtain a separate suture of the mucous membrane, Küster incised the penis between the corpora cavernosa from below to the corpus spongiosum urethræ above throughout the entire length. The corpora cavernosa were now rotated inward ninety degrees, and were sutured when apposed over the mucous membrane of the urethra. These lateral incisions were carried along the bladder as far as possible, and a separate suture of its mucous membrane and muscular coat was made, over which the abdominal walls were closed. By this method the urethra lay between the corpora cavernosa, and the region of the sphincter vesicæ was relieved of all lateral traction which tended to prevent its accurate closure. At this time Küster had operated upon only two cases,—one an epispadias, the other an epis-

padias with exstrophy of the bladder. In one, continence for several hours was attained; in the other, the continence was less marked. Which of these cases was the continent one, Küster has not made very plain.

Bergenheim,⁵⁵ in this same year, reported two cases in which a slightly modified Czerny's operation was used. One of the cases died from a pyelonephritis, which antedated the operation. In the other case no continence of the bladder was obtained. During this year we find several operations for exstrophy performed by the method suggested by Maydl, or by a slight modification of it. Among these, Mikulicz's case, which had a fatal issue four months after operation from a pyelonephritis, was remarkable in having an incomplete rectal continence, so that a receptacle for urine was required.⁵⁶

Of Maydl's two cases, one was successful and one was unsuccessful. The unsuccessful case died as the result of chloroform narcosis. The successful case was seen six months after operation, at which time the rectal continence lasted from four to four and one-half hours. In this case both urine and fæces were passed together.⁵⁷

Schnitzler in the same year used this method of implantation in a somewhat modified way which gave rise to intestinal fistulæ, for the cure of which the patient was subsequently operated upon and died.⁵⁸

Wölfler⁵⁹ and Krinsky⁶⁰ adhered closely to Maydl's suggestions in two cases with successful issues. One case was seen one year after operation, at which time rectal micturition and defecation took place every four to four and a half hours. At this time no hernia nor renal tenderness could be elicited. The bed was wet only in the deepest sleep. The other case was seen eight months after operation. At this time the rectal continence was perfect, and no evidence of kidney involvement was observed. In 1896, Fowler⁶¹ implanted the ureters into the rectum after a method of his own designed to combine an efficient valve action with compression of the ureters by the circular fibres of the intestine.⁶² This case was a successful one. The rectum was almost immediately tolerant for a space

of three hours. One year and six months from the time of operation, the tolerance had advanced until "the intervals were normal." In observing the subsequent course of this case, Fowler noticed that rectal micturition occurred once in six hours, while a formed movement apparently free from urine occurred once in twenty-four hours. This fact Dr. Fowler explains by the action of the sphincter of O'Beirne, above which the fæces accumulated until just before a desired evacuation took place.

In this year we find Von Eiselsberg⁶³ operated upon two cases. Trombetta,⁶⁴ Resegotti,⁶⁵ Ewald,⁶⁶ Korteweg,⁶⁷ and Wölfler⁶⁸ each operated upon one case in a manner practically Maydl's. In Von Eiselsberg's cases, in spite of intestinal fistulæ resulting from the operation, the patients recovered. In one case, a man, evacuations from the rectum occurred three times a day, and seldom at night. Usually in this case there were two urinations and one defecation. In the other case, a child, the evacuations occurred five or six times daily. At night the bed was wet during deep sleep. These two cases were seen one year from the time of operation. They presented no evidence of any kidney involvement. It is interesting to note that in the man, who previously had not experienced sexual desire, a libido sexualis appeared several months after operation.

The cases operated upon by Ewald, Wölfler, Trombetta, and Resegotti were all successful. In Trombetta's case, the rectal evacuations occurred two or three times a day and three or four times at night. In Resegotti's case, the evacuations occurred five or six times in twenty-four hours. In Wölfler's case, the rectal continence at night was good; it being necessary to awaken the child but once, while during the day the urine was retained for three hours at a time. In the intervals the patient was perfectly dry. This child was seen fifteen months after operation and was still in the same condition. In Ewald's case, which was seen eighteen months after operation, the rectal continence lasted for six or eight hours at a time. The patient was not disturbed at night, nor were there

any subjective or objective symptoms of kidney involvement.

In Korteweg's case the result was at first good, the patient being able to retain 500 centimetres of urine at a time. Later, however, an ascending ureteritis, with nephritis and pneumonia, supervened, to which the patient succumbed. There was no record of the condition of the ureters before implantation, though it is probable, from the autopsy, that the kidney involvement antedated operation.

In this year we find that Resegotti⁶⁹ operated by the following method upon one case of exstrophy of the bladder in a female:

(1) Formation of the bladder by skin-flaps taken from the abdomen and labia majora; (2) A vaginorectal fistula; (3) A vesicovaginal fistula; (4) Colpocleisis.

In this case the urine was voluntarily passed per rectum every three or four hours. Following an enteritis, a double-sided pyelonephritis supervened, to which the patient succumbed.

At about this time (1896) Poisson⁷⁰ gave a statistical summary of fifty-two cases occurring during the preceding six years. Of the fifty-two cases, thirty-six were operated upon by some form of the autoplasic method, ten cases by Segond's method, six cases by uretero-intestinal anastomosis. Of the fifty-two cases, four died, and all four were operated upon by the Trendelenburg method. Of the ten cases of Segond's method, five showed good results, three developed a gangrene in the flaps, one was a delayed healing, and one died three months after operation from a pyelonephritis not depending upon operation. Of the six uretero-intestinal anastomoses, none died and all had rectal continence.

Trojanaw⁷¹ during this year operated by the autoplasic method upon a single case with success in so far as the immediate result was concerned, but without developing a continent bladder. The patient was observed four and one-half years after operation.

During the year 1897 the efforts of surgeons seem to have

been divided between the implantation and the autoplasic methods. Ewald,⁷² Tuffier,⁷³ Herczel,⁷⁴ and R. Park⁷⁵ each operated upon a case by Maydl's method with three successes and one death. In the successful cases the rectum was continent for four to five hours at a time. The shortest time of observation was three months after operation.

In this same year Koch⁷⁶ attempted to modify Trendelenburg's operation by substituting an osteoclasis for the osteotomy at the sacro-iliac articulation. Under narcosis with the pelvis fixed, Koch broke by hand pressure the sacro-iliac articulation, and immediately apposed the bones at the symphysis pubis. After six weeks' retention in apparatus, a plastic operation upon the bladder and penis was undertaken. The case upon which this method was attempted was reported only five days after the operation. No details were then given of the capacity or continence of the bladder. This method, which is applicable only to young children, undoubtedly obviates one of the dangers of the Trendelenburg method. During this year we find that Czerny,⁷⁷ Murray,⁷⁸ and Pozzi⁷⁹ operated upon four cases by differently devised, but in the main similar, autoplasic methods. In Murray's case no continence was obtained. In Czerny's case the bladder was also incontinent. In Pozzi's case the capacity of the bladder was fifteen to twenty centimetres, and its retentive power lasted just twenty minutes.

The year 1897 furnishes us with no valuable data except the successful cases of Maydl's method and the modification of the Trendelenburg method by Koch.

During the year 1898, Duret,⁸⁰ Patel,⁸¹ Phocas,⁸² and Owens⁸³ operated upon five cases by slightly differing autoplasic methods with success, in so far as the immediate danger to life was concerned. In no case, however, was the bladder continent, and in all the constant use of a urinal was required. They may therefore be dismissed without further comment. During this year, Estor,⁸⁴ Forgue,⁸⁵ and Sonnenberg⁸⁶ presented in all nine successful cases operated by Sonnenberg's method, and Poisson⁸⁷ reported a case of modified Segond's

operation. These operators strongly advocated the above methods as preferable to the autoplasic and implantation methods, in that they secured an equally good result in shorter time and with less future risk of an ascending ureteritis.

In the same year, Ewald,⁸⁸ Tuffier,⁸⁹ Frank,⁹⁰ Herczel,⁹¹ Boari,⁹² Crespi,⁹³ Capello,⁹⁴ and Pozza⁹⁵ presented nine successful cases of Maydl's implantation into the sigmoid flexure (variously modified). In Frank's case, twenty days after operation, the urine was retained from one and one-half to two hours during the day. During the night, the urine was retained without effort. In the other cases, the rectal continence lasted from three to five hours. At the meeting of the K. K. Gesellschaft der Aerzte in Wien, at which Frank's case was shown, Gersuny described his modification of Maydl's operation, which in short consisted in

(1) A transverse separation of the rectum from the sigmoid flexure, and an implantation of the ureters and base of the bladder into the lumen of the rectum at its point of division.

(2) An implantation of the end of the sigmoid flexure into the anterior wall of the rectum behind the rectovesical or recto-uterine peritoneum as close as possible to the sphincter ani. This suggestion was successfully carried out, and resulted in a good artificial bladder and anus, both with continence.

In May of this year, Rutkowski,⁹⁶ wishing to avoid the late danger of uretero-intestinal anastomosis, attempted to construct out of a coil of small intestine and the small and deformed bladder, which his case presented, a capacious and contractile organ, with possibly sphincter action at its orifice. The case Rutkowski selected was one which during the previous two years had been subjected to the Trendelenburg and Rydygier methods without success, except for the cure of the epispadias. By means of a median incision a six-centimetre coil of intestine was isolated from the lower portion of the ileum. The afferent and efferent coils were united and replaced within the abdomen. The isolated segment was divided by a longi-

tudinal incision along the surface opposite its mesenteric attachment, and the resulting quadrilateral piece was sutured to the loosened edges of the bladder. The abdomen was then closed. The wound united by first intention. Eight weeks after operation the bladder held twenty-five centimetres of urine. The bladder was not a continent one, and the patient, as in other autoplasic methods, was obliged to rely upon mechanical pressure to retain the urine.

Mikulicz, in June of the same year, knowing such isolated segments of intestine often atrophied, operated much in the same manner at several "sittings," extending over a period of eight months.⁹⁷ A fistula in the lower angle of the wound persisted for sixteen months longer. At this time the capacity of the incontinent bladder was 100 centimetres of urine, and the length of time the bladder could be made to retain urine under mechanical pressure was only one hour.

In the year 1899, a much less irksome and probably less dangerous procedure was advocated by Mundel,⁹⁸ the object of which was to close the defect in the bladder with normal bladder tissue. Mundel's course of procedure was about as follows:

(1) Between the superficial and deep fascia of the abdominal wall engraft an exsected portion of the bladder wall of a sheep in such manner that the edges of the bladder and the submuscular connective tissue become attached to the superficial fascia, while the mucous membrane is protected from the deep fascia by the interposition of gold foil.

(2) After eight days, when the union is complete, the flap, consisting of the skin, subcutaneous tissue, and bladder wall, is to be swung over the defect and sutured. Mundel transfers the flap to the defect in the bladder on the ninth day, believing that its early exercise will avoid connective-tissue transformation and muscular atrophy.

During 1899, we find references to thirteen new cases of Maydl's method of implantation, with ten successful and three unsuccessful issues. Nové Jossierand,⁹⁹ Von Winiwater,¹⁰⁰ D. P. Allen,¹⁰¹ Maydl,¹⁰² Von Eiselsberg,¹⁰³ Herc-

zel.¹⁰⁴ Of these ten successful cases, in none was the rectal continence less than three hours. In none have reports of later infections occurred. In the three unsuccessful cases death was due to the operation.

During this same year we find recorded one case operated upon by Fowler's method, with a fatal issue two months after operation as the result of kidney infection,¹⁰⁵ two successful cases of lateral implantation of the ureters into the rectum by Peters and Cameron,¹⁰⁶ and one unsuccessful case of Gersuny's modification of Maydl's implantation.¹⁰⁷ During this year, Frank, of Chicago,¹⁰⁸ recommended, as a substitute for the uretero-intestinal anastomosis, the formation of a vesico-rectal fistula, with suture of the divided bladder and abdominal wall. This method, which is a simplification of the method originally performed by Lloyd, and subsequently by Athol Johnson, Holmes, Thiersch,¹⁰⁹ and Novaro, Frank believes is less dangerous from possible ureteral infection or ureteral constriction by the bowel scar than other methods of establishing communication between the intestinal and urinary systems. His mortality in animals was 33 per cent.; but when we consider the difficulties to be overcome in animal asepsis, we can leave this out of consideration and suspend criticism until a series of cases are reported by surgeons.

The articles of Branth¹¹⁰ and of Chavasse¹¹¹ are interesting communications, and suggest possibilities in otherwise hopeless cases. W. J. Walsham¹¹² during this year reported a case of modified Mikulicz operation, and during the clinical lecture at which the case was exhibited referred to another case he had recently seen where the retentive power of the bladder existed for two and one-half hours, although the urethra and bladder had not yet been united to each other. No exact details were given as to the method of operation in this case, or of the exact degree of malformation for which the boy had been operated.

Wheaton¹¹³ also reported a case operated upon by the autoplasmic method with superimposed flaps. No vesical control was obtained. A urinal applied was satisfactorily worn.

J. R. Eastman¹¹⁴ successfully removed the kidney upon one side and sutured the remaining ureter into the epispadiac groove. This case was reported in excellent health one year later.

During the year 1900, Lewis¹¹⁵ and Young¹¹⁶ each reported a case of exstrophy of the bladder with epispadias in which no operations had been performed. In both of these cases the urinal worn had worked with satisfaction. Anchutz,¹¹⁷ Carl Beck,¹¹⁸ Lotheisen,¹¹⁹ Delageniere,¹²⁰ and Vance¹²¹ each reported cases of the autoplasic method with varying results. Anchutz gave the final result of Mikulicz's attempt to increase the capacity of the bladder by uniting with it an excised portion of the ileum. In this case the urine was retained by means of a pelotte for one and one-fourth to one and one-half hours. The capacity of the bladder was fifty to sixty centimetres. The urine was acid, free from albumen, sugar, and peptones. Under forced pressure the bladder would hold 110 centimetres. This observation was made nineteen months after the first operation. Anchutz reserves this method for adults in whom a deficient bladder is present, and in whom intestinal implantation is not advisable.

Beck reports two cases. In one case the method employed was similar to Rydygier's. In the other, the method was his own, and consisted essentially in covering the sutured bladder wall with two quadrangular and lateral flaps made up of the skin, subcutaneous tissue, and one-half the thickness of the rectus muscle. In neither case was the bladder continent.

Of Lotheisen's two cases, one was operated upon by Von Hacker, the other by himself. Von Hacker's case, which was an extreme one, with a large bladder and a six centimetre separation of the pubic bones, after ten operations and thirty-nine months' treatment, could retain the urine within the bladder for three to four hours by means of a pelotte. There was no voluntary continence, and at night the urine flowed away every hour.

Lotheisen's case was an incomplete exstrophy of the blad-

der,—a high grade of epispadias with four centimetres' diastasis of the pubic bones. After six operations, extending over a period of thirty-four months, a partial continence was obtained, which Lotheisen considered an active continence. The condition thirty months after the operation was an incontinence at night, and during the day a continence lasting one hour.

Delageniere's case, which was operated by the Trendelenburg method, with seven supplementary operations, was briefly reported as having a perfectly functioning sphincter vesicæ.

Vance's case, which required seven operations and two years' treatment, was seen six months after the last operation. At this time the capacity of the bladder was about four ounces. There was no voluntary continence present. A urinal was required to keep the patient dry.

During this year, Enderlen,¹²² who carefully reviewed the work of Tizzoni and Foggi,¹²³ and that of Rosenberg¹²⁴ upon animals, as well as that of Rutkowski and Mikulicz upon man, concluded that any sized defect in the bladder can be cured by uniting with it an excised portion of the ileum. The disadvantage of this method was, however, the formation of a diverticulum and its attending complications. "In exstrophy of the bladder it will increase the capacity of the bladder without developing continence or avoiding kidney infection from cystitis."

At this time, Summers¹²¹ reported a case of exstrophy in which the bladder and vagina were united, and in which a urinal was to be applied to the vaginal orifice. A. E. Halstead¹²⁵ performed the first Frank's operation during this year. The operation was not a successful one. The patient died of shock forty-eight hours after operation. Jaia¹²⁶ also gives a report of four intestinal implantations of the ureters for exstrophy performed by Colzi. Observations of these cases were made at seven months, one year, and four years after operation, at which times the patients were in the best of health. In no case was there evidence of proctitis, and in all the anal sphincter was competent for four to five hours.

During the year 1901, two admirable articles have appeared relating to this subject. One by Peterson,¹²⁷ "Uretero-intestinal Anastomosis," the other by Connell,¹²⁸ "Exstrophy of the Bladder." The former lays great stress upon the high mortality attending axial implantations in man (44 per cent.); the relatively high percentage of recoveries following the Maydl method in man (86 per cent.), and the probabilities that the Frank method will be less fatal and ultimately less liable to ureteral infection than the axial implantations. Both observers show in their animal experiments that the bilateral implantation is usually fatal from sloughing at the site of the implantation and from an infective peritonitis; that the dogs dying within a few days, as well as those which recover, acquire dilated though patent ureters and evidences of an ascending ureteral and renal infection (pyelonephritis, nephritis, and contracted kidney). Both observers show that the same results follow the lateral and the unilateral axial implantations.

Peterson moreover shows that in the eleven dogs operated upon by the trigono-uretero-intestinal method, five recovered, and in these neither was the renal infection when present so severe nor so rapid as in the other method. He also maintains that no valve guards the vesico-ureteral orifice, and no sphincteric muscular action is exerted by the ureteral or vesical muscle upon the ureter.

In reviewing the results of the various methods of treatment of this condition, we pass over without special notice the autoplasmic methods represented by the operations of Nélaton, Wood, Thiersch, and Hirschberg. We discard them on account of the frequent presence of cystitis with calculi and the long time required to secure a closure of the bladder and of the epispadias. The methods of Billroth and Czerny, in which the bladder was lined with mucous membrane, as well as the methods of Trendelenburg, Rydygier, Schlange, Mikulicz, and König, where, in addition to a bladder lined with mucous membrane, a closer apposition of the tissues at the intended vesical orifice was secured, obviated the occurrence of calculi and the repeated cystitis; but they failed to reduce the mor-

tality, to shorten the time of operative treatment, or to produce a continent bladder except in the single case of Trendelenburg.

For these reasons surgeons have been divided in their opinions as to the best course to pursue. Many have and still believe that every effort should be made to preserve the bladder, to establish its function, and to give it a proper capacity. Some, on the other hand, believing a restoration of the function of the bladder impossible, and seeing no advantage in its retention, sacrifice it, and divert the urine to the intestine, where rectal continence will be established. A few, believing that all methods which have preserved the bladder have failed to produce continence, and that the possible future infection of the kidney in uretero-intestinal anastomosis cannot be eliminated, extirpate the bladder completely and, uniting the ureters to the closed urethra or to the vagina, make use of a urinal.

The more recent efforts of the first class have been directed to (1) The establishment of a continent bladder; (2) Increasing the capacity of the bladder; (3) Approximation of the tissues at the symphysis pubis.

Of the cases reported to have continent bladders, we find only one undoubted and well confirmed case. This case was Trendelenburg's, which was seen by Tietze eight years after operation, and at that time showed a voluntary vesical continence lasting two hours, and a vesical capacity of forty to fifty centimetres.¹²⁹

The two cases of König where the vesical continence was reported to be "like that of a normal being" unfortunately died within one week of operation,—one from an infective peritonitis, the other from pneumonia. Owing to the recumbent position of these patients and the very short period of investigation, the operation will require repetition to prove its value in this respect.

Küster's cases,¹³⁰ one of which was reported as having a very satisfactory result, were not observed for any length of time after operation, as Küster himself says, nor does he

make it clear that the continence occurred in the case of exstrophy of the bladder and not in the case of epispadias.

Walsham's case¹³⁰ was operated upon some years before, and presented a continence lasting two and one-half hours. This remarkable result was merely mentioned as a fact, without any details as to the degree of deformity for which an operation had been performed nor of the operative procedure used. Under such conditions, we are justified in not considering it a proven case of continence until a more precise statement is published.

Poppert's case of displacement of the vesical orifice to the floor of the bladder and beyond the intended union of bladder wall and urethra was reported as having a capacity of 150 centimetres and a continence of three or four hours. The time at which the paper was read describing the method and the case was just seventeen months from the date of the last operation. It is presumed, though not stated by the author, that his case was seen shortly before its publication. If this was so, the case is a very remarkable one; for the permanency and completeness of the continence are apparently established by the length of time intervening between the last operation and the reading of the paper. As no other method of operation has attained such a result, and as the method is equally applicable to all degrees of deformity, its value should be quickly determined by repeated operations. It is unfortunate that no further statements about this case have been made.

Lotheisen's case, which was seen thirty months after operation, had continence for one hour at a time during the day; at night, incontinence. The above case seems to show that by persistent efforts a union and gradual development of sphincteric muscular fibres is possible. It would be interesting to hear of this case again. In reference to Delageniere's case of a "perfectly functioning sphincter," I have not yet been able to obtain the original account. Should this case be correctly reported, it is the only case of a perfect restoration of function, and demands wide-spread publicity. The number of cases in which continence has been reported are six, if we

leave out König's cases, which died within one week of the operation. Of these cases, one has been seen and confirmed eight years after operation.

In securing apposition of the tissues at the symphysis pubis, distinct advances are seen in the suggestions of Koch and König. Koch broke by hand pressure upon the sides and front of the pelvic girdle the sacro-iliac articulation and apposed the pubic bones immediately. In the single case of Koch this apposition was secured in six weeks. By this means the real risk of the Trendelenburg method was obviated and the tissues in the vicinity of the symphysis were apposed. This method is to be selected for the younger children where the degree of deformity presupposes the establishment of a capacious and possibly continent bladder. In older children and in adults, the suggestion of König to divide the rami of the pubis as the best means of apposing the tissues and correcting the upward divergence of the pubic bones at the symphysis seems to be, if not too dangerous, a very practical one.

Another advance in the treatment of this affection is seen in the proposals of Rutkowski, Mikulicz, and Mundel for increasing the capacity of deficient bladders. Of these recommendations, the least dangerous seems to be that of Mundel. In cases where the malformation is represented by deficient bladders, and the probability of attaining continence is present, or the use of a pelotte is intended, one of these methods, especially Mundel's, might be tried. It must be evident, however, that by this method the capacity in the bladder only is increased.

All modifications of existing operations, and in fact all proposals so far offered, have failed to secure a continent bladder under voluntary control, except in the cases we have enumerated, and of which only two cases seem to be worthy of imitation. Provided this one desideratum can be accomplished, the existent methods and their modifications will be found capable of fulfilling every other demand.

Because the autoplasmic methods have failed to produce continent bladders and patients have been obliged to rely upon

apparatus either to retain or to catch the urine, a class of surgeons has suggested the procedure introduced by Sonnenberg and his imitators as requiring less time in execution and as giving an equally desirable result.

In cases of extensive deformity, especially where the bladder is small and the separation at the symphysis is marked, Sonnenberg's method is not only simpler in execution, but its results are equally as good as the small, incompetent bladders made by the autoplasic methods. The question of the advantage offered by one or the other of these methods depends, in my mind, solely upon the possible future capacity of the bladder to be developed by operation.

Of the methods for diverting the urine into the vagina, little can be said in their favor except as a *dernier ressort*. Of the four cases operated upon in this manner,—Summers,¹²¹ Pawlik,¹³¹ Charvasse,¹³² and Kossinsky,¹³³—Pawlik's was the most successful. In his method, after removal of the bladder and a union of the ureters and vagina, the anterior and posterior walls of the vagina were sutured to the corresponding walls of the urethra. The urine was then withdrawn by catheter. Three years after operation the patient was reported well.

Of the methods for diverting the urine into the bowels, we mention that of Maydl, Fowler, Krinsky, Martin, Gersuny, and Frank.

Of these six methods, three—Maydl's, Frank's, and Gersuny's—attempt to imitate that condition in vertebrates in which the urodeum is present, and at the summit of which each ureter enters by a papilla. Frank's and Gersuny's methods imitate this condition more closely than Maydl's method; yet the essential point in each is the same; namely, "an intact ureter" at its entrance into an artificial urodeum. Under these conditions it is reasonable to suppose that, provided the ureters are not infected at the time of operation, the remote dangers will not be greater than the dangers existing in any ectopic bladder into which the ureters are emptying and are constantly exposed to infection. When we compare the sta-

tistical results of those methods in which the ureteral closure at the vesical end has been undisturbed with those methods—axial implantations—in which this closure has been disturbed, we find that Maydl's method, representing the former class, is strikingly superior to any of the axial implantations representing the latter class. Preference for this method has been brought about by the fact that the former high mortality of uretero-intestinal anastomosis was reduced by this method from 50 per cent. to 10 per cent., Nové Jossierand; 14.3 per cent., Mazel; 20 per cent., Bax; 20.5 per cent., Lotheisen; 14 per cent., Peterson.

The greatest number of cases I have been able to collect have been forty, with seven deaths. These forty cases represent cases of the Maydl operation, or such modifications of it as do not interfere in its essential character. Four of these deaths were described as deaths from operation, 10 per cent. (shock or narcosis). Of the three remaining, one was reported as a death from pyelonephritis four months after operation; another was said to have died a few months after operation from "an abscess;" while the third died some months (fifteen) after operation of a pyelonephritis and pneumonia. We have therefore three cases in forty dying of infective processes at some time following operation (7.5 per cent.). In this same number we have two cases reported as having rectal incontinence. One of these cases was Mikulicz's, in which the sphincter ani had been incised to secure a permanent drainage on account of an infective urethritis and local peritonitis. Before the patient died, four months later, the rectum was continent for three-quarters of an hour at a time.

Of these forty cases, twenty-one were reported as well at one year; ten were reported as well at two years; seven were reported as well at three years; one was reported as well at seven years.

The high mortality (100 per cent.) accompanying Maydl's operation performed upon animals by Connell, Kalabin,¹³⁴ and Matas¹³⁵ cannot furnish any reliable data for or against similar operations upon man, for in each of these cases death oc-

curred from septic peritonitis, a danger so far, for the most part, avoided in operations upon man. Moreover, as Matas himself maintains, the operation upon man is simpler and more easily accomplished than upon the dog. Hence we must rely upon the clinical work so far done, aided by such animal experimentation as Peterson has presented.

The experimental work upon animals by the Frank method has been attended with a very high mortality, 33 per cent. In all of Frank's cases, moreover, which recovered, evidences of renal infection existed. In Peterson's experimental work, some of the cases were free from such infection. Of the seven cases of exstrophy of the bladder which have been treated in this fashion (Frank, Resegotti), two died from peritonitis, and may be well excluded as being done at a time when the technique was not as well understood as at the present time. One case should be excluded because of a failure to establish the anastomosis; one because the bladder was never closed after the anastomosis was made. Of the three remaining cases, one died from a pyelonephritis, one from shock, and one patient was alive eight months after operation.

In order to compare the method with others, we must wait until a larger number of cases are obtained for investigation. This we should be willing to do, for Frank's experimental work has simplified the technique of the method, and has demonstrated that in all cases the bladder remained free from feces. What we wish to know now is (1) the relative danger of a remote infection of the urinary tract in this method as compared with the Maydl method; (2) whether the technique of the operation can be made simpler than that of the Maydl method.

The axial implantations of the ureters, both in man and in animals, show a very high mortality. For all classes of cases this mortality reaches as high as 33 per cent., while in exstrophy of the bladder the mortality has been as high as 44 per cent. Of the eleven cases performed, five have died. Four of these died of pyelonephritis a few months following operation, while one died of shock immediately following op-

eration. In Connell's as well as in Peterson's experimental work upon animals, it is interesting to note the high mortality following a bilateral axial uretero-intestinal anastomosis. No less striking is the fact that in all unilateral axial implantations, the ureter implanted was at the autopsy stenosed and dilated, while the kidney showed acute or chronic nephritis. In all of these cases both cocci and colon bacilli were found in the ureter and kidney. So far, the best results have been obtained by Maydl's method; yet instances will occur where a direct implantation of one or both ureters will be necessitated. When such a condition arises, we may select Fowler's, Krinsky's, Martin's,¹³⁶ or Beck's¹³⁷ method of direct implantation. These methods seem to be of equal value. In none has a closure of the ureters by the bowel muscle resulted, nor has a permanent valvular closure of ureter been produced. Such extensive procedures as Gersuny's or Mauclair's scarcely seem justifiable without a promise of greater practical result than can be secured by simpler methods of implantation.

Uretero-intestinal anastomosis (Maydl's)—the radical method—is a very enticing and seductive procedure because of its rapid and satisfactory immediate result. The province of surgery, however, is not to sacrifice organs that can be saved, and conservatism in the treatment of this condition is still a desirable factor. Where the anomaly is such as to suggest the possibility of establishing a capacious and continent bladder, the implantation methods seem to me as much contraindicated as they would be were the patient suffering from an ascending ureteritis or a weak and inefficient sphincter ani.

In young children the upward divergence of the two pubic bones and the distance between them are at their minimum. The puboprostatic and the pubovesical ligaments and muscles exert at this time their slightest lateral traction, and the greater portion of the bladder, in consequence of this, is to be found above the level of the symphysis.¹³⁸ If at this time the position of the pubic bones is corrected, and all lateral traction upon these ligaments and muscles is relieved, a complete, or at least a partial, continence should be obtained in carefully

selected cases. To relieve the lateral traction on these ligaments and muscles, Koch's suggestion of osteoclasis in early life seems most worthy of a trial. To close in the bladder and penis after approximation of the pubic bones by the above method, Küster's suggestions seem the most rational. By this method not only are the frontal and sagittal relations of the corpora cavernosa to each other and to the urethra restored, but a separate suture of the muscular coat of the bladder in addition to that of the mucous membrane of the penis and bladder is secured. This method of procedure should be confined to children under six years of age, in whom the bladder is large, the diastasis of the pubic bones is slight, and in whom the apposition of the pubic rami can be secured previous to the closure of the bladder. In older children and in adults this lateral traction and separation of the pubic bones cannot be sufficiently relieved even in carefully selected cases unless some radical means be adopted. König's suggestion to divide the horizontal and descending rami of the pubic bones and to displace them to the median line, if it can be proven to be less fatal, seems to have been the most promising of a successful continence in the bladder. Though König's two cases were fatal, the deaths were due to accidental causes, which might be avoided in future operations. In children over six or eight in whom the bladder is large and the diastasis at the symphysis is moderate, König's method, in my opinion, should be given a further trial. In children in whom the bladder is deficient, and in adults where, from the long duration of the anomaly, the bladder has become concentrically hypertrophied and the diastasis of the pubic bones has greatly increased, uretero-intestinal anastomosis, unless distinctly contraindicated by the condition of the ureters or the intestine, is the operation of choice. Among these cases there will always be some where the uretero-intestinal anastomosis is inadvisable. For such cases, I would, as a *dernier ressort*, extirpate the bladder and anastomose the ureters and urethra. (Sonnenberg.)

The retention of the bladder and the restoration of the

penis as a useful organ contribute much to the "morale" of the patient, and is an achievement for the surgeon; yet the good effect is so intimately associated with a continent bladder, that all methods destined to this end will remain more or less unsatisfactory until we are able to establish it with greater certainty.

I have added the histories of five cases operated upon by me since 1888. These cases represent all degrees of deformity. In only two cases can I say that the result is satisfactory to me. The failure to attain more perfect results in the other cases is to be regretted.

CASE I.—(July 23, 1888, Bellevue Hospital.) P. S., aged thirteen years. Patient was operated upon one year ago in a manner described as follows: "The mucous membrane between the ureteral orifices and over the prostate was removed. The ureters were dissected free for half an inch, drawn down and sutured to the mucous membrane of the urethra. The ureters, however, did not remain where sutured, although, when healing was complete, they were closer to the urethral mucous membrane than originally." Since the operation the boy has worn a urinal. At present the boy is well nourished and strong. Above the symphysis there is a defect, the size of a golf-ball, composed of everted mucous membrane which is red and bleeding. In the upper half-circumference the mucous membrane resembles horny epithelium. In the lower half-circumference the prominent ureteral openings are seen, and the spot described as having its mucous membrane removed in the former operation can be distinctly seen. The recti muscles diverge to their insertions, which are two and one-half inches apart. The penis is one and one-half inches long. The rectum is close to the symphysis. The bladder can be easily replaced. Urine negative.

July 25, Bellevue Hospital. Ether. Operation. Two lateral and parallel incisions were made along the urethra and over a No. 13 F. catheter; these flaps were sutured with silk. The raw surface exposed was covered by a Nélaton's scrotal flap, beneath which the penis was placed.

August 8. The lateral attachments of the flap were cut, and the sides of the flap were sutured to the freshened edge of the parallel incisions on the dorsum of the penis. The raw surface over the scrotum was covered by apposing the side of the space from which the scrotal flap was taken.

August 14. Union of the epispadias operation was good.

August 15. Ether. Operation. A quadrilateral umbilical flap was cut, with its base above the margin of the bladder. This was reflected downward and over the exposed mucous membrane after its margins were freed of epidermis for a distance of one centimetre. A circumferential

incision about the margin of the bladder was now made, and the bladder was dissected free from the abdominal wall for a distance of one and one-half centimetres. Its margin was sutured to the raw surface of the umbilical flap in such a manner that the mucous membrane and the epidermis were apposed. The sutures avoided entering the cavity of the bladder. This flap was then covered by two lateral Thiersch flaps. Just above the urethra, the umbilical and the abdominal flaps were sutured so as to appose their epithelial surfaces. The denuded surfaces left after transposition of these flaps were closed as far as possible and packed with iodoform gauze. No attempt to unite the urethra and the bladder was made.

September 15. The wound has been daily dressed as required. The ulcers left by the transplantation of the flaps are nearly healed. The flaps have united. The urine continues to flow from the opening left between the urethra and the bladder.

October 3. Operation. Ether. The margins of the orifice between the urethra and the bladder were freely freshened, and small superimposed flaps, taken from the side of the abdomen and scrotum, were applied as in the former operation for closure of the bladder. A permanent catheter was passed to the bladder.

October 5. This did not act well, becoming clogged from time to time.

October 6. It was removed, but a small fistula had already been formed at the site of the last operation.

October 10. The union of the flaps has been good except for the formation of the fistula above mentioned.

October 20. Operation. Fistula excised and sutured with fine silver wire.

October 27. United.

November 1. Patient has a urinal. Bladder incontinent. On pressure the bladder holds fifty centimetres.

November 13. Patient desires to go home. Is discharged. Patient prefers the urinal to the pelotte.

December 1, 1899. A note received from the patient states that he still wears the urinal. No stones have formed in the bladder. He is in good health. Time under treatment, four and one-half months. Result: Incontinent bladder holding under pressure fifty centimetres of urine. Patient, however, prefers a urinal to a pelotte.

CASE II.—(April 1, 1894, Roosevelt Hospital.) T. G., aged eleven years. Boy of moderate muscular development. On viewing the abdomen, a protrusion of mucous membrane, which is very tender and is covered with a yellow deposit, is seen. In the lower third of this area two symmetrical and prominent slits are seen,—the ureters,—from which the urine comes in drops. The upper two-thirds of the circumference is marked by a pigmented or cicatricial zone. The symphysis is wanting, and the rami of the os pubis are five centimetres apart. They are held by a strong band which is just beneath the commencement of the urethra. The bladder is hypertrophied and thrown into not effaceable rugæ. The penis is likewise divided: it is two and one-half centimetres long. The prepuce is

redundant and the scrotum and testicles are normal. The urinary examination is negative. The anus is normally developed and continent.

April 1. Careful treatment for the irritation about the bladder was instituted. This was successful.

April 8. Operation. Ether. A large quadrilateral umbilical flap was prepared, including the skin, subcutaneous tissue, and deep fascia, with its base attached just above the upper margin of the bladder. Along the margins of this flap, for a distance of one and one-half centimetres, the epidermis was removed, exposing the subepithelial connective tissue. An incision passing from the lateral margin of the reflection of the umbilical flap above to the lateral margin of the urethra below and following the edge of the bladder was made upon each side. This incision extended as far as the peritoneum, and the bladder wall was loosened for a distance of one and one-half centimetres. The edge of the reflected umbilical flap and that of the bladder wall were now sutured in such manner that mucous membrane and epidermis were continuous. The stitches, which consisted of catgut, involved only the submucous and subcutaneous tissue. When this was accomplished, two lateral flaps, each large enough to cover half of the surface of the exposed area, were prepared as recommended by Thiersch. They were transplanted, and were sutured with silk to one another as well as to the lower edge of the umbilical flap. A small catheter was inserted into the bladder and a sterile dressing with iodoform powder was applied. This dressing was frequently removed. The union of the flaps was good. No fistula occurred.

April 10. The greater portion of the stitches was removed. The ulcers above the umbilical flap and those at the sides of the Thiersch flaps are granulating nicely.

April 20. All stitches have been removed. The ulcers are healing nicely. Patient still remains in bed. Scarlet fever developed to-day and patient was transferred to hospital for contagious fevers.

July 5, 1899. New York Hospital. Patient was seen to-day for the first time since 1894. He wears a urinal which fits imperfectly, and, although he attends school and mingles with others without attracting attention, he desires to have a better fitting apparatus. The possibilities being explained, he desires to avoid the uretero-intestinal anastomosis, and insists upon saving the bladder and urinating through the penis. Since the capacity of the bladder was thirty centimetres, and no stone formations nor cystitis have taken place within four years, an epispadias operation was decided upon with the object of applying a pelotte to retain the urine in the bladder, if possible.

July 5, 1899. He was admitted to New York Hospital.

July 7. Operation. Ether. Perineal section was performed. A catheter was introduced within the bladder. Thiersch's method of operation was then carried out at one sitting. Time of operation, one and one-half hours. Patient recovered nicely from the operation. Dawbarn's method of continuous drainage was then applied with catheter. Aseptic dressing.

July 8. The bladder drains well and no leakage has occurred between the stitches.

July 12. The drainage is perfect. The patient is careful, and aids the treatment in many ways.

July 15. During the night the patient had a dream, thrashed about his bed, and tore open his wound. The hæmorrhage from the wound was excessive. He assures us that he was absolutely unconscious of tearing it during his sleep.

July 16. An attempt to reunite the flaps was not considered feasible. He was advised to leave the hospital as soon as the wound healed and to return this year for operation. To this he has assented. Owing to this failure, the probable cicatricial condition of the dorsum of the penis will render a subsequent epispadias operation of doubtful utility. If this be the case, I shall implant the base of the bladder with the ureters into the rectum or make a vesicorectal fistula (Frank's method). This case cannot be considered a finished one in any sense; for its result we must wait until another operation is performed. I feel that, under any conditions, a success in the latter operation would not have given a result as good as a vesico- or a uretero-intestinal anastomosis is likely to do.

CASE III.—(March 14, 1894, New York Hospital.) H. V. S., aged eight years. Patient well nourished. Has a complete exstrophy of the bladder with an epispadias. In the lower angle of the protruded mucous membrane are seen the ureteral orifices. They are prominent. Urine escapes from them almost continuously. The upper circumference appears cicatricial. The mucous membrane resembles epidermis. The navel is seen just at the level of the vertex of the bladder. The diastasis of the pubic bones is five centimetres. The penis is two and one-half inches long. The anus is situated near the scrotum and is continent. The scrotum is well formed and contains the testicles. The urinary examination is negative. After several days' treatment the excoriations about the bladder were healed, and Czerny's method for closing the bladder was considered as best.

March 14. An incision circumscribing the bladder mucous membrane was deepened until the peritoneum was reached. The bladder wall was now dissected from the surrounding peritoneum as far as the ureters upon the sides and anteriorly and posteriorly. This dissection freed the bladder wall at all points except beneath the urethral mucous membrane and the base of the bladder. The bladder was now closed by two layers of sutures,—one layer apposing but not penetrating the mucous membrane, the other apposing the wall after the manner of a Lembert suture in the intestine. The line of sutures passed from the vertex of the bladder to a point opposite the urethral mucous membrane, beneath which a catheter was introduced into the bladder. Over the united bladder wall the abdominal wall could not be united without relieving incisions made along the outer border of the recti muscles and carried as far as the transversalis fascia. The patient recovered from the operation nicely. An aseptic dressing was applied, and was changed as frequently as necessary to keep the wound dry.

March 20. Drainage worked well until yesterday, when the pressure of the urine forced an opening through the lower one-fourth of the line

of skin sutures and just above the catheter. The catheter was withdrawn and the urine was allowed to drain through opening.

March 29. The tissues have united well above. The bridge between the fistula and the opening seems to be diminishing in size. There is, of course, no continence; the urine dribbles continuously.

May 10. This operation has proven a fruitless one, and the patient's parents wish to have another attempt made.

July 24. Patient, who has been upon a vacation, re-enters the hospital for a new attempt.

July 25. Ether narcosis. A large quadrilateral umbilical flap was taken from the abdomen above the defect and was reflected over the opening. It was sutured as in the other cases described, and was covered by two lateral pedunculated abdominal skin flaps (Thiersch's). These lateral flaps were carefully sutured to one another and to the lower border of the umbilical flap. A catheter was now introduced into the bladder and the flaps were united as closely over it as possible. The drainage was good and required no extra help.

July 29. The catheter has been removed to-day. The drainage has been good. The union of the flaps promises well.

August 10. The flaps have firmly united except at the left hand upper corner; here a small fistula remains from which the leakage is very slight.

August 20. The bladder has remained united. The fistula is still present. Leakage from it is insignificant.

September 12. Patient is advised to go home and to return for operation after a vacation.

May 21, 1895. Patient returned to the hospital to-day. The vesico-urethral orifice has not enlarged. A Thiersch method of operation was adopted. Before operating upon the penis, a perineal incision was made and a tube inserted into the bladder, which was stitched to the skin of the perineum to prevent its slipping. The necessary longitudinal incisions both in the glans and in the penis were made and the flaps were united, after which the prepuce was slit and sutured in position. The vesico-urethral junction was closed by continuing the Thiersch incisions for the urethra beyond the orifice. Silk sutures were used throughout the operation. Dawbarn's use of the Spengel pump was adopted for securing a continuous drainage.

May 22. Drainage is satisfactory.

May 29. Tube has been removed. Urine flows through the urethra. In bed, the child holds his water for a short time before it flows away; apparently a pure elastic contraction of the orifice.

June 3. All stitches have been removed. A small fistula is present at the juncture of the bladder and urethra. It is not an inconvenience, however. There is positively no continence.

June 27. Patient discharged improved. He wears a well fitting urinal and refuses to make use of a pelotte. Capacity of the bladder was fifty centimetres.

November, 1897. A communication from the parents states that the

fistula has healed. No continence is present. A urinal is worn and fits in a satisfactory manner. This patient had three extensive operations, one of which was a complete failure. Spent in the hospital 173 days, and attained an incontinent bladder which required the use of a urinal. A pelotte might have been applied in this case, and would have been, in my opinion, more satisfactory to the patient. Its use was not entertained by the patient.

CASE IV.—(August 3, 1896.) G. B., aged two years, a boy, robust in build, suffers from a complete exstrophy of the bladder with epispadias. The bladder mucous membrane is extensively protruded, is vascular, and bleeds easily. The ureteral orifices present below and are one and one-half centimetres apart. The diastasis of the pubic bones is one and one-half centimetres. The penis is small. The scrotum is normal and contains the testicles. The anus is normal, continent, and somewhat near the scrotum. The bladder can be easily reduced within the abdomen and seems to be of considerable size. On this account the bladder is to be preserved. An incision circumventing the bladder margin was made, which completely surrounded it except at the urethra. This incision was carried as in Czerny's method, subperitoneally, until the bladder was free upon all sides as far as the entrance of the ureters upon the sides and an equal distance posteriorly. The bleeding was not great. The bladder was then sutured with silk apposing but not penetrating the mucous membrane. Above this row a series of Lembert stitches was inserted, holding the bladder wall in broad apposition. These stitches were inserted in a line from the vertex of the bladder to the urethral mucous membrane. Great care was used to loosen all tension at the neck of the bladder and to bring the muscular wall in apposition. The urethral orifice was made as small as possible, possibly for a No. 12 F. catheter. Over this line of union the abdominal wall was united after incisions passing as far as the transversalis fascia and along the outer border of the recti from a point over the umbilicus to below the pubic rami upon each side were made. This tissue, which included practically the rectus muscle of each side, was transposed towards the median line and united. The only point offering any resistance was at the attachment of the rectus to the pubic ramus. These were subsequently separated with a rugine and closely attached in the median line.

August 8. The union in this case was complete on the sixth day after operation, when all stitches have been removed. In only one place was there a failure in union. This resulted in a small fistula which persisted, but from which urine flowed only occasionally.

August 10. The catheter is retained without difficulty. It does not become clogged. Union has remained permanent.

August 14. Catheter is removed to-day. Treatment the same.

August 15. The patient seems to retain his urine for half an hour, when it flows without his being able to void it voluntarily.

August 27. Patient retains his urine about one-half hour. After this time it flows away without his being able to restrain it. The bladder holds thirty centimetres at this time. The mucous membrane of the bladder

seems to be filling the orifice between the urethral mucous membrane and that of the bladder, and becoming more and more prominent.

May 31. Patient was prepared for the epispadias operation. The epispadias, which was complete, was operated upon after the manner of Thiersch at one sitting. Perineal drainage. Dawbarn application of the Spengel pump for drainage. The patient became very restive under treatment. Several of the stitches were torn out, requiring a repetition of the operation in part on June 20. The union following this operation was complete, and on July 21 the patient was discharged from the hospital in the following condition: Closure of the bladder and penis complete. Urine retained in the bladder for half an hour. Amount of urine retained, fifty centimetres. Patient wears a urinal, but is advised to use a pelotte.

May, 1898. Patient was seen by me. The use of the pelotte has been satisfactory, and the bladder can retain urine for one to two hours at a time, not infrequently a longer time.

CASE V.—(February 5, 1900, New York Hospital.) C. M., aged three and one-half years. The boy is well nourished and well developed. Three centimetres below the navel and just above the symphysis pubis, a swelling, formed of mucous membrane, protrudes. This is epidermis-like above, while below it is red, and shows upon its surface the openings of the ureters. The bladder is surrounded by a narrow zone of connective tissue. The diastasis of the symphysis is three centimetres. The horizontal rami of the pubes are held together loosely by a mass of tissue connecting their posterior surfaces (the puboprostatic and vesical ligament). This allows a wabbling gait. The penis is completely epispadiac. It is three and one-half centimetres long. The scrotum is small and contains both testicles. The prepuce is redundant. The urethral mucous membrane shows plainly the openings of the glands, especially Cowper's. The anus is near the scrotum, is continent and well-formed. The urine catheterized from ureters is normal. For several days previous to operation salol was administered, and for two days previous to the operation the large intestine was repeatedly irrigated with borosalicylic solution.

February 22. Operation. Ether narcosis. A median incision from the umbilicus to the vertex of the bladder, and then circumventing the bladder upon each side as far as the symphysis, was made. Upon the sides and front of the bladder a subperitoneal dissection of the bladder was made as far as the entrance of the ureters. The urethra was now divided, and the dissection of the base of the bladder from before backward was carried on until it was entirely free. A semilunar piece, two and one-half centimetres by two centimetres, containing the ureters, was now separated from the rest of the bladder. During the dissection of the bladder, care to remain in the subperitoneal tissue was taken. The arterial supply requiring ligatures consisted of six arteries (three upon each side.) After the hæmorrhage was checked, the rectum was exposed and, being compressed above, a vertical incision was made on its anterior face, two and one-half centimetres in length. The semilunar piece of the bladder containing the ureters was now rotated ninety degrees to

the left, and was carefully sutured to the margins of the incision in the rectum by a series of catgut stitches in the submucous tissue of the bladder and the rectum. Over this layer a series of silk stitches was made, including the serous, muscular, and submucous coats of the intestine and the muscular and submucous coats of bladder. After a careful toilette of the field of operation, the abdominal wall was brought together and sutured throughout its greater part. The lower angle just above the symphysis was packed with iodoform gauze. A tube was inserted into the rectum.

February 26. All sutures were removed except the tension sutures. The lower angle of the wound is granulating nicely. The bowels are daily irrigated three or four times with borosalicylic solution.

February 28. Tension stitches removed; otherwise treatment is the same as on February 26.

March 1. Tube was removed. Urine was passed every hour day and night.

March 3. Urine passed four times to-day and twice last night. Urine is mixed with feces. Child begins to appreciate the feeling for rectal micturition and asks the nurse to help him.

March 17. Since last account the urine is made three times during the day and once or twice at night. Intestinal antiseptics discontinued.

March 30. Patient now appreciates thoroughly the desire to urinate and asks for a vessel. The rectal continence lasts four hours. At night he rarely wets the bed unless neglected before going to bed. Defecation usually occurs once daily in the morning with urination.

March 27, 1901. Patient is still in good condition. There is no renal or rectal irritation or tenderness. Urine was passed every four hours. At night once, unless child is neglected before going to bed.

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THE TREATMENT OF FRACTURE OF THE NECK OF THE FEMUR.¹

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FROM early days fracture of the neck of the femur has been counted among the most serious of accidents, its successful treatment one of the most difficult, and its results among the most uncertain of the problems of surgery.

It has been counted among serious accidents because very many of the victims die within the first eight weeks, and of those who survive a large percentage are left practically helpless cripples for the remainder of their lives. The successful treatment has been difficult because surgeons have treated these fractures along lines diametrically opposed to the principles and practice of the treatment of all other fractures. The results have been uncertain because some few patients have recovered with useful limbs, despite the treatment which they have received, treatment which ought to have given uniform results, that is to say, uniform failure to obtain strong and useful union.

It is quite as true in surgery as in medicine, that an honest and observing practitioner often finds it difficult to satisfy himself whether the patient got well with his assistance or despite his interference.

Before discussing methods of treatment, I wish to say a

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few words about the classification of these fractures. In the days of Sir Astley Cooper these fractures were divided into intracapsular and extracapsular fractures. To be sure, the diagnosis was not generally made at the time of the accident; it could not be safely made at that time, but it was made when the results of treatment became manifest, into intracapsular when a useless limb resulted, and into extracapsular when a useful union was obtained, and the surgeon rested secure in the dictum that union could not take place in fractures within the capsule. You will, of course, remember that the whole of the neck down to the intertrochanteric line is within the capsule in front, and nearly all of it is also included at the back of the bone, and that a fracture that is not partly, or wholly within the capsule must be beyond the intertrochanteric line, and consequently not a fracture of the neck of the femur at all.

Further, it is not necessary for me to point out to you that fracture into other joints is no bar to perfect bony union when treated by fairly accurate replacement of the fragments, and efficient retention for a reasonable time. Evidence that intracapsular fractures never unite is wanting; evidence that these fractures always unite when properly treated is abundant; indeed, there is abundant evidence that they occasionally unite when treated by methods that favor motion far more than immobilization. Indeed, there can be little doubt that the chief use of the classification into intracapsular and extracapsular was for the purpose of excusing the failures due to unintelligent treatment.

The more recent classification has been into impacted and unimpacted fractures; it being held that impacted fractures resulted in union, provided they were not disengaged by a meddlesome surgeon, or separated later by effusion along the line of impaction. Post said: "The surgeon, in his anxiety to obtain a perfect diagnosis, moves the limb freely in all directions; he overcomes the impaction, ruptures the cervical ligament, demonstrates beyond a doubt the existence of fracture, and effectually destroys all hope of reunion. For my part, I

prefer an imperfect diagnosis for the surgeon and a perfect limb for the patient, rather than a perfect diagnosis for the surgeon and a useless limb for the patient."

A positive diagnosis of impaction is not, and never should be, made. If the shortening is not more than three-fourths of an inch, and if the lateral and rotation deformity is not great, impaction may be assumed until measurements show that the shortening or the deformity has increased. But when the shortening or the deformity is great, it may be assumed that the fracture is unimpacted; at any rate, it should be treated as if it were unimpacted, by replacement in a useful position, immobilization, and fixed traction. The result will often be more perfect than in impacted fractures.

Like the early classification, this later classification is mainly useful in covering up the inefficiency of the surgeon. The real classification which men make, no matter by what name they may call it, is fractures that unite and become strong and useful, and those that do not unite, or at least do not become strong and useful.

The question of bony union and fibrous union is one productive of much worry to many surgeons. It is a matter of no more importance than in fractures of the patella. A fibrous union that is short enough and strong enough to give as good a functional result as bony union is every bit as good as bony union, and cannot be told from bony union except by a Röntgen photograph. Stimson says:

"Even if we disregard all existing specimens of alleged bony union, the possibility of such union must, I think, be admitted, because of the demonstrated fact that the head preserves its vitality, and has shown its ability to produce granulations and bone; the former proved by examples of fibrous union, the latter by eburnation or condensation of its spongy tissue. More than this, it has been shown, even, that pieces of bone completely detached may regain complete vascular connection and bony union with the piece from which they have been broken, and, therefore, it is proper to assert that it is theoretically possible for the completely detached head of the femur to regain connection with the

neck, much more so for one that has preserved more or less of its fibrous connection. Fibrous union after fracture is demonstrated by several specimens. *Ossification is merely the ultimate step in the evolution of the granulations arising from bone*; and it has been shown in the study of the failure of union, of pseudarthrosis, that the arrest of the process is commonly due to lack of immobilization, defective contact, or constitutional peculiarities, of which old age is not one. Prolonged complete immobilization of a fracture of the neck of the femur is practically impossible; accurate coaptation of the fractured surfaces is a matter of chance, and the reason of the habitual failure to get bony union is to be found in the inability of the surgeon to meet the two principal indications of treatment,—coaptation and immobilization; not to any inability of the tissues themselves to do the work required of them."

This, then, is the view of the general surgeon who admits "habitual failure to get bony union." While Thomas, that archorthopædist of all time, who out of more than forty cases never failed to get a strong and useful union, said: "To improve our results we want knowledge that will aid repair, not better mechanics to gain results."

The most recent author on fractures, Charles Locke Scudder, says, "The impacted cases will unite; the unimpacted cases *may* unite. Slight shortening with little deformity, some limitation in the movements of the hip, a limp, but a fairly useful limb, are to be *hoped* for." Let me assure you, gentlemen, that in all these cases a strong and useful union, giving a strong and useful limb, in good position may be as confidently anticipated as in any other fracture of this bone or any other bone. In no other fracture is the surgeon's task easier; in none is a good result more certain. This despite Scudder's results, namely, "In only two cases out of sixteen could it be said that the leg was functionally useful."

I believe Scudder's unsatisfactory results are due to imperfect principles and imperfect treatment. His principles are embodied in the following words: "In the case of a fracture of the neck of the thigh-bone occurring in an elderly individual,

treat the patient, and let the fracture be of almost secondary importance."

I believe we can only treat the patient properly by properly treating the fracture from which she is suffering and likely to die. He (Scudder) says, "Asthenic hypostatic pneumonia from long-continued resting in one position is not uncommon. Therefore, moving about a little in bed, to the extent of sitting up on a bed-rest at varying angles, is beneficial." Is it surprising that patients grow weak from suffering when "allowed to move about a little in bed, to the extent of sitting up on a bed-rest at varying angles," the fractured hip meantime *not* being immobilized? Is it surprising that "asthenic hypostatic pneumonia . . . is not uncommon," when patients lie in bed with "the foot of the bed . . . elevated to the height of six inches"? Indeed, would it not be surprising if this were not the result of these methods of treatment?

Here in detail is the method recommended by Scudder.

"The knee should be placed upon a pillow. Extension strips of adhesive plaster should be applied to the leg and thigh as high as the perineum, and should be held to the skin by a gauze roller bandage. A weight of about five pounds should be applied to the extension while the leg is gently rotated and carefully placed approximately in the normal position. The foot of the bed should be elevated to the height of six inches in order to secure counterextension. Long and heavy sand-bags should be placed on each side of the leg and thigh to assist the light extension in affording support and to give a sense of security. . . . To afford still greater immobilization, a long T-splint extending from below the foot to the axilla of the injured side *may* be applied by straps around the leg and a swathe about the body. During the second week he may be bolstered up on pillows to the half-sitting position. Ordinarily, the extension may be removed during the third week. The patient may be lifted to another bed or divan and be rolled into an adjoining room. In this change the thigh should be supported by sand-bags. The patient may be up in a wheel-chair after the first six weeks or two months with the knee straight on a board or, if comfortable, flexed. He may use crutches and a high shoe upon the well foot, not bearing any

weight upon the injured hip after two months or ten weeks. He should not bear weight upon the hip, even with the assistance of crutches for about three months. At the end of a year he *may* be walking with one cane. The foregoing is, of course, an ideal case, treated according to the old-time simple extension and partial immobilization method. . . . The simple method is far from ideal. Malunion and non-union with resulting disability too often follow its use, the period of disability is long, and *the ultimate results are often most unsatisfactory.*"

I am not surprised that "the ultimate results are often most unsatisfactory." Five pounds' weight acting over a pulley will neither move the leg in traction nor counteract retraction from muscular contraction. Sand-bags help to secure the leg and thigh, *i.e.*, the lower fragment; but why immobilize the lower fragment when the upper fragment is left free? Why immobilize it part of the time when it is moved every time the bed-pan is used? Sitting up in bed during the second week strains any new union that may have formed by moving the upper fragment. The patient should not sit up until twelve to sixteen weeks after all pain has disappeared. Extension, if used at all, should be fixed extension (traction), and not movable or elastic extension (traction), and it should be continued at least six weeks after the pain has ended. The patient is more comfortable in bed than on a divan or in a chair. Why move him and risk breaking up the new union? In making such a change, how can the thigh "be supported on sand-bags"? How does that immobilize the fractured hip?

I am quite in accord with the proposition that since we have for the most part elderly persons to treat for this lesion, it becomes very important that means are used which least hamper them, and that we refrain as much as possible from all purposeless restraint. *Per contra*, any lack of restraint which prolongs the suffering, or the period of disability, or renders less certain a useful limb, is not a method often to be desired.

In considering rules of treatment, we must never lose sight of the main point, namely, "We want a rule of treatment that

will reduce the number of failures of repair down to the average failures attendant upon the treatment of other bones."

Thomas laid down these rules as the essentials of treatment: "*First*, to uninterruptedly and as effectively as possible arrest flexion of the hip-joint. *Second*, to continue the treatment until the symptoms of genuine repair and soundness of the joint are diagnosed. *Third*, to obtain the best possible restoration circumstances permit, so that no lameness attributable to flexion be a permanent reminder of the treatment."

With these rules I would fully agree, but I would express the same thought in another way, to wit: *First*, replace the bones as far as is practicable, *i.e.*, replace them sufficiently to correct unsightly deformity and to give a useful limb when recovery has taken place. *Second*, retain the bones in this position by as complete immobilization as it is possible to give until firm union has resulted. *Third*, limit the use of the broken bone until all unsoundness has passed.

If some consideration were given to an unsound joint as well as to unsoundness at the point of fracture, there would be less complaint later on of disability from "chronic rheumatism."

In a word, a fracture of the neck of the femur should be treated precisely as any other fracture should be treated; and the unsoundness of the joint should be treated precisely as unsoundness in any joint from any cause should be treated. No one thinks of treating fracture in the central portion of the shaft of the femur without the most perfect reposition possible; yet fracture of the femoral neck is usually treated without any attempt at reposition. In the shaft every surgeon makes use of the most perfect means of immobilization at his command, immobilization in every direction; and yet the same surgeon will treat a fracture of the neck of the same bone with no attempt at immobilization unless it may be to lateral movement, which from the nature of the fracture is scarcely needed. In fracture of the shaft no sane man thinks of subjecting the newly united bone to a bending strain equal to the full weight of the patient for months after the union is complete, but in fracture of the

neck of this same bone practically every surgeon tries to get his patient up within twelve weeks, and in doing so subjects the new union to a transverse bending strain almost great enough to break old bone. It ought to be a matter of no surprise when the new union gives, the head sinks lower, and the joint is left weak and useless for months and years.

The average surgeon treats fracture of the neck of the femur precisely as he treats a solution of bony continuity where he aims to get a false joint; and, verily, he usually has his reward. My plea is simply this: Show the fracture at the neck of the femur the same consideration that you show all other fractures. It is useless to quibble about fractures within the capsule and fractures outside the capsule; fractures impacted and fractures unimpacted; about the thin, weak bone of fat old women; these cases invariably result in strong and useful union if they are given a fair chance.

The following are the various methods of treatment:

- (1) Rest in bed, without protection.
- (2) The short side-splint.
- (3) The long side-splint.
- (4) Weight and pulley traction—alone or combined with sand-bags or a long or short side-splint.
- (5) The side-splint supplemented with elastic traction.
- (6) The side-splint supplemented with fixed traction.
- (7) The plaster-of-Paris spica.
- (8) Senn's plaster-of-Paris method.
- (9) Shaffer's method, *i.e.*, the long traction hip-splint and surcingle.
- (10) Ridlon's long traction hip-splint.
- (11) The Thomas hip-splint.
- (12) Ridlon's modification of Thomas's hip-splint.

(1) Treatment by rest in bed, on a level and firm mattress, without any fixation dressing whatsoever, frequently results in union, in patients where the fracture is impacted, or incomplete, and where the shortening is less than three-quarters of an inch and the rotation deformity and lateral deformity are

slight. It must be remembered, however, that spontaneous separation of the fragments with greatly increased shortening of the limb and disability not infrequently supervene at the end of two weeks, and in some instances as late as the end of the fourth week. Whether this is due to some unconscious movement on the part of the patient, or to the action of the inflammatory exudate, or to some other cause, is not positively known; we know only the clinical fact that separation does occur, and that when it does occur good strong union is far more difficult to be had. It is my personal opinion that this late separation of the fragments is due to unconscious movement on the part of the patient, since it has not been known to occur in patients treated with efficient immobilization.

(2) Treatment with the short side-splint, or the T-splint, reaching only to the waist, has little to recommend it over no treatment at all. The simple short side-splint does not restrict motion of the point of fracture except in the last half of the normal range of motion. The T-splint restricts rotary deformity, but does not restrict flexion or extension movements, and from resting on the bed below the foot probably acts to crowd the limb upward and increase the shortening.

(3) The long side-splint, when applied to a fat woman, does not restrict the normal range of extension; it permits motion in flexion to about forty degrees, but controls fairly well the lateral and the rotary movements.

(4) Weight and pulley traction anchors the limb to the bed, but it does not restrict motion if the patient is permitted to sit up in bed; it restricts lateral movement of the limb; but does not restrict lateral movement of the body, and movement of the upper fragment on the lower is quite as undesirable as movement of the lower fragment upon the upper. All the beneficial effects of weight and pulley traction are, however, fully or more than counterbalanced by the fact that the traction is elastic, that is to say, it is not fixed traction. In fracture of the neck of the femur, movement of one fragment on the other in the long axis of the body is the one movement least controlled by the splinting of the soft parts, and weight and pulley

traction acts to increase instead of to diminish this movement. When the patient sleeps and the muscles are relaxed, the weight and pulley traction draw the lower fragment downward; when the patient awakes, the reflex muscular contraction causes the lower fragment to slide upward again. Thus the use of weight and pulley traction rather increases than diminishes movement between the fragments.

Weight and pulley traction used in combination with the long side-splint is a favorite method of treatment. To be sure, the long side-splint counteracts in a measure the evil effects of the weight and pulley traction; but the combined method does not provide against sliding of the fragments one on the other, nor does it offer any restriction to the anteroposterior movements that must result every time the bed-pan is placed beneath, or removed from, the patient.

(5) The long or short side-splint with elastic traction at the foot and countertraction from a perineal strap has nothing to recommend it over the same side-splint with weight and pulley traction.

(6) The long side-splint with countertraction from a perineal strap and fixed, inelastic traction at the foot is far better than any of the methods so far considered; but it makes no provision against anteroposterior movement when the bed-pan is used or the bed changed.

(7) The plaster-of-Paris spica, as usually applied, extending upward only to the waist-line, permits anteroposterior and lateral motion to about thirty degrees; but it restricts rotation movements and longitudinal movement of the fragments to a great extent. The main objection to the use of plaster of Paris will be considered under the next heading.

(8) Senn's method of treatment consists in the use of plaster of Paris on the fractured limb from the toes and on the sound limb from the knee, and extending to the eighth rib. In addition, an opening is left over the greater trochanter, a metal bridge set in the plaster crossing this opening, and bearing a set screw armed on its inner end with a pad, which can be made to impinge on the greater trochanter, and when the screw is

set presses upon the bone with the intention of effecting an artificial impaction.

This plan of treatment must be considered from two stand-points: That of artificial impaction from the pressure of the screw-pad, and, second, that of immobilization of the fracture. If there were no displacement of the fragments, or if the fragments could surely be replaced with end-to-end apposition, doubtless the screw pressure-pad would help to immobilize the fracture if the pressure could be borne. But, as a matter of fact, we know from Röntgen photographs that there usually is an anteroposterior displacement which cannot be fully corrected by any manipulative procedure, and that pressure on the greater trochanter in the direction of the acetabulum sufficient to move the lower fragment will add to the displacement instead of effecting artificial impaction. The screw pressure-pad was devised before the Röntgen photograph had given us accurate knowledge of the relation of the fragments, but no one heretofore has taken the trouble to relegate it to the limbo of prematurely born theories.

The plaster splint, the screw-pad aside, as applied by Senn, from the toe of the broken leg and the knee of the well leg to the eighth rib, is the most effective method of immobilization that one can well conceive. The fracture is immobilized in every possible direction, and all the muscles having influence upon the hip-joint are put at rest, a very important consideration. If the victim of the accident were an artist's lay-figure, or even a wooden Indian from the front of a cigar-store, no better plan of treatment could be had; but for a fat old woman of eighty, with an irritable bladder, the Senn method leaves much to be desired. To apply a plaster splint to the body and to both legs in a fat woman with a broken hip, at least four assistants and some fairly complicated mechanical devices are necessary, if one is to do it without disturbing the fragments. It requires consummate skill to apply a plaster splint to the hip and body of a fat woman, and have it free from ridges on the inner surface. It is practically impossible to hold the patient suspended for the plaster to set in the posture which

she naturally assumes when lying in bed, and unless this is done pressure-sores may result from the impinging points of the plaster. It is not possible to discover these points of pressure beneath the plaster case. The patient will perspire, and the under-surface of the cast will be moist. It is rarely possible for her to use the bed-pan without soiling the cast at the back of the sacrum. One can hardly risk leaving a splint of this kind on without change for more than three or four weeks, and it may have to be changed at the end of a week. With every change of cast the four assistants and the tackle must be again utilized, and the change from the old to the new cast can hardly be effected without movement at the point of fracture. If pressure-sores have perchance developed, the treatment must be abandoned for some simpler method, or the patient left to curse God and die. No, the Senn method is not nearly so smooth in actual use as it is on the printed page. My advice is, Don't try it in any except hospital cases, where abundant help and every mechanical facility are at hand.

Thomas is, however, entirely right in his contention that plaster extending farther below the hip than it does above has no additional immobilizing action, and is an added burden to the patient, and that a screw pressure-pad set in a plaster splint cannot possibly act in any other way, or in any way more effectively than a broad muslin bandage about the hips.

(9) Shaffer's method of treatment appears to be based on the excellent results obtained in two cases of late or delayed union. It consists of the application of the conventional long traction hip-splint, of the form used in the treatment of hip disease, and a surcingle buckled snugly around the pelvis pressing upon the greater trochanter. This splint immobilizes the hip to some extent, but as has been shown by Lovett allows about thirty degrees of motion. It appears to me a useful appliance in cases where soft union has already taken place and where some protective ambulatory appliance is demanded; but it has not proved in my hands a satisfactory and efficient method in early fractures, while no union exists and patients are confined to bed.

(10) A somewhat similar method is by the use of the Ridlon long traction hip-splint, which is shown in Fig. 1, and which by extending well up on the chest gives much more perfect immobilization. It consists of a long traction hip-splint of the conventional pattern, but locked fast at the hip-band, and a thoracic attachment also locked fast to the hip-band. This splint, when well fitted, gives nearly as perfect immobili-

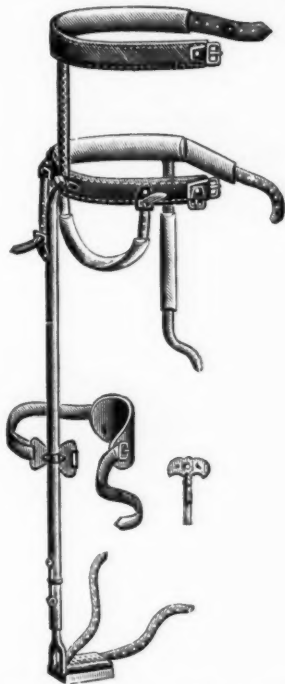


FIG. 1.—The Ridlon long traction hip-splint. This splint is particularly useful in treating fractures of the femoral neck in children who may not be trusted with crutches, and as a convalescent walking splint.

zation as the Thomas splint, and is a far safer appliance in children who cannot be trusted to remain quietly in bed for the full period, and who also cannot be trusted with crutches when once allowed up. The splint is more than three times as expensive as the Thomas splint, and requires far greater mechanical skill in its adjustment and management.

(11) In the Thomas hip-splint (Fig. 2) we have an ap-

paratus which secures posterior support to the fracture, gives fixation without compression of the fractured region except posteriorly, allows the patient to be lifted with ease, does not interfere with the groin, favors cleanliness, admits fixative traction, can be applied without moving the patient and without assistance, and presents no difficulties after the initial application.

The splint (Fig. 3) is made from soft iron, and consists of a main stem, a chest-band, a thigh-band, and a calf-band. The stem is an inch and a quarter wide and one-fourth inch thick, and in length reaches from the axilla to the calf of the leg; the length of the lower portion from the hip-joint to the

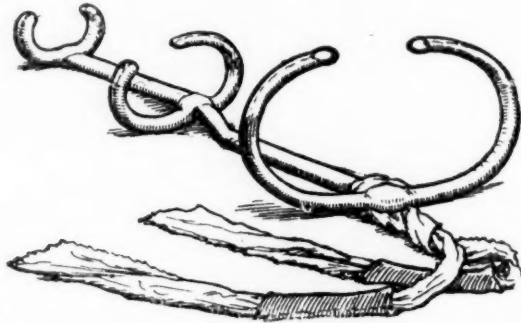


FIG. 2.—The Thomas hip-splint; for use in cases of impacted fracture. The swathe of cloth shown in the illustration goes to make the shoulder-straps that support the brace.

calf of the leg being equal to that from the axilla to the hip-joint. In the part opposite the buttock two gentle bends are made, the lower somewhat backward and the upper forward, so that the body and leg portions of the splint follow parallel lines from one-half to one inch apart, the body portion being posterior to the leg portion. The stouter the patient, the more nearly do these parallel lines coincide, and in some cases the main stem may be left entirely straight. To the lower end is fastened by one rivet the calf-band, one-sixteenth by five-eighths inch, and in length an inch or two less than the circumference of the leg at this point. The thigh-band is one-sixteenth by three-fourths inch, and in length an inch or two less

than the circumference of the thigh at its largest part; it is riveted to the main stem just below the lower bend, so that when applied to the patient it comes well up to the perineum. The chest-band is three thirty-seconds by one and one-fourth inch, and in length nearly equal to the circumference of the chest, being relatively longer than the other bands. It is fastened by one rivet after the upper end of the stem has been forged flat and bent back over it. This arrangement makes a

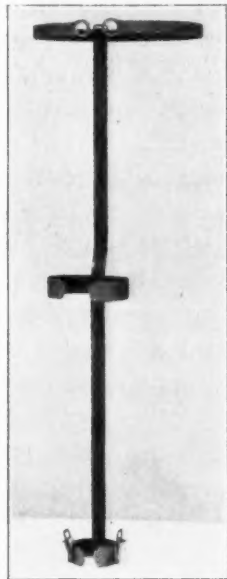


FIG. 3.—The Thomas hip-splint, shown without padding and covering to illustrate the manner of manufacture. Buckles have been attached to the ankle-band for fixed traction. The shoulder-straps are left off, and the traction results from the tendency of the brace to work down.

fast joint and brings the stem between the chest-band and the skin. In each end of the chest-band a round hole is forged of at least one-half inch diameter. The splint is now bent to approximately fit the patient, padded on the side which is to come next the skin with a quarter-inch thickness of felt, care being taken to leave no inequalities of surface, and then covered with basil leather put on wet and tightly drawn, so that when dry it will have shrunk sufficiently to prevent the cover from slip-

ping on the iron. The splint is applied by opening out the wings of the bands looking to the uninjured side of the patient and then slipping them, followed by the stem, underneath the patient from the injured side; the wings which were straightened are bent again by hand and readily return to their former curves. A closer and more accurate adjustment of the wings may be made by the use of the wrenches; these will be found especially serviceable in fitting the chest-band, and in drawing in the other bands when the patient is very intolerant of any threatened movement or jarring.

When it is possible, it is better to fit the splint to the patient before she has been moved from the spot where she has fallen. The splint having been fitted, if retentive traction is not required, the limb is bandaged to the stem from the calf to the upper part of the thigh, rolling the bandage in the direction the opposite of the rotary deformity which may be present; then shoulder-straps are applied by taking a couple of yards of broad bandage, or a strip of muslin, looping it around the stem where it joins the chest-band, thence over the band and up over the shoulders and down to the ends of the chest-band where it is passed through the holes and tied, and then passed across the intervening space to the opposite hole and again tied. If retentive traction is desired the shoulder-straps are omitted; in a thin patient the limb, after having been pulled down in the splint, can be secured by a figure-of-eight bandage over the knee fastened to the splint with a large pin passed through it and the covering at the back of the splint, but in a stout person this will rarely hold, the splint slipping down or the limb riding up; then we apply a broad strip of adhesive plaster to each side of the limb from the upper part of the thigh, turning the lower ends outward and upward around the wings of the calf-band, where they are fastened by a strip of plaster passed entirely around the limb; the whole is then covered with a bandage as in the first instance. By this arrangement the limb is pulled upon only to the extent of correcting the actual shortening, and is held at one and the same length sleeping or

waking, whether the muscles relax or are spasmodically contracted.

The device aims to prevent motion in the axis of the limb; to prevent lateral motion by bending the limb in any direction; to do this without circumferentially constricting the region of the fracture; and to enable the patient to have the bed-pan adjusted without pain and without disturbing the relation of the parts. When the splint has been applied and the patient is in bed the nurse should be instructed in certain manœuvres. The bed-pan is adjusted by passing an arm under both limbs at or below the knees and then lifting directly upward, making an incline of the whole patient below the chest-band. By this manœuvre it is also more easy to smooth out wrinkles in the bedding and change the sheets than in the usual way. The skin pressed upon by the stem should be changed night and morning by pulling it slightly, first to one side and then to the other, and the patient should be inspected daily for pressure-sores by turning her on the sound side.

To turn a patient upon the sound side, support the fractured limb at the knee with one hand, and, grasping the chest-band with the other, the patient is readily turned as a whole. The points most likely to suffer from pressure are those at the junction of the thigh-band and stem, the lower bend of the stem, and the junction of the stem and chest-band. Points pressed upon should be lightly dressed with balsam of Peru and protected from further pressure by padding above and below the point. If the pressure of the whole body portion of the stem is complained of, a small, thin mattress of hair or a sheet folded to several thicknesses may be placed between the splint and the patient's back. Threatened hypostatic congestion is obviated by raising the head of the bed from one to three feet, and the patient is prevented from slipping down in the bed by tying the splint to the head of the bed.

For the sake of fixed traction I am accustomed either to attach buckles to the calf-band, looking upward to receive the tape from strips of adhesive plaster applied to the lateral sides

of the limb, or (12) a modification of the Thomas splint, shown in Fig. 4. This splint consists of the main stem and leg-bands of a Thomas splint, with buckles on the lower band for the traction-straps. It has in addition a hip-band, armed with perineal straps, like the conventional long traction hip-splint, for countertraction, and the chest-band is made after the same shape as the hip-band for easier adjustment. This splint gives

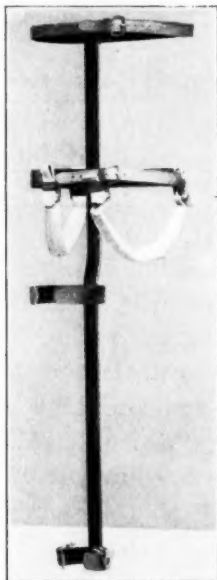


FIG. 4.—The Ridlon modification of the Thomas hip-splint. A hip-band is added, for countertraction, shaped like the hip-band of the Ridlon long traction hip-splint, and the chest-band is changed to the same shape. This renders the adjustment somewhat easier. This splint costs much less than the Ridlon long traction hip-splint; it can be made by any country blacksmith and shoemaker; and it is more effective than the Thomas splint.

all the fixation advantages of a Thomas splint, with the addition of more reliable fixation traction.

In the use of any of these fixation appliances in patients over seventy years of age, they should be kept in bed with the splint on for at least six weeks after the cessation of night pain;

and then should be kept in bed an additional four weeks after the splint has been removed. In patients between sixty and seventy years of age, the splint should be kept on at least eight weeks, and there should, of course, be an additional four weeks in bed without restraint. The younger the patient, the longer must be the mechanical control. In old persons, and in all who suffer much pain during the days immediately after the fracture, the same care should be given to the diet that is demanded after serious abdominal operations, namely, the diet should be restricted to such articles as are entirely or almost entirely absorbed. Solid food and milk should be prohibited, and the bowels should be left undisturbed for at least three weeks, in order that the patient may be disturbed to the least possible extent.

To recapitulate the principles:

Stimson says, "The first consideration is to keep the patient alive; the second to obtain union; the third to get union in a good position." I cannot fully agree with this. I would not make it the first consideration to keep alive a patient of threescore and ten years if she must be bedridden or a helpless cripple for all the rest of her life. Indeed, a woman of eighty may live ten years, and a younger woman had better be dead than a helpless cripple for ten years. Further, the occasion of death in a large percentage of cases is not the shock of the accident, nor the shock from the replacement of the fragments, nor the confinement in bed, but it is from the pain and suffering resulting from irrational treatment.

It appears to me that the first consideration should be to relieve the patient from suffering. This can best be done by replacing the fragments as completely as possible, and retaining them by the completest possible fixation. If the patient can possibly live, she will live when freed from pain.

The second consideration should be to use such an immobilizing dressing as will least irritate the patient, as will make it possible to keep her skin clean and dry, and free from pressure-sores; such a one as will permit the use of the bed-

pan and the turning of the patient in bed without pain, for pain means movement of the fragments one on the other.

The third consideration should be to continue immobilization of the fracture and protection from all sensitiveness.

Fourth, continue the treatment of the hip until the joint is sound as well as the fracture united.

WOUNDS OF THE VENOUS SINUSES OF THE BRAIN.¹

AN ANALYSIS OF SEVENTY CASES.

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IN the following paper I have embodied the results of a study of seventy cases of wounds of the great venous sinuses of the brain, collected from various sources. Of these cases five have come under my personal observation; and it was this experience which led me to investigate this class of injuries with special reference to their frequency and mortality, and to the determination of the method of treatment which has been employed with the most satisfactory results.

CASE I.—H. R. Wharton. Boy, twelve years of age, was admitted to the University Hospital, 1882, having been struck upon the occipital bone by the point of a stick thrown at him with great violence, producing a scalp wound, a little to the right of the occipital protuberance, an inch in length, and also a depressed fracture of the occipital bone three-quarters of an inch in diameter. The patient presented no marked brain symptoms at the time of his admission. On the day following his admission, Professor Ashhurst decided to elevate the depressed bone. The scalp wound was enlarged to give freer access to the wound in the bone. Several fragments were removed with the elevator and bone forceps, and upon the removal of the last fragment there was a furious gush of venous blood. Attempts were made to control the bleeding by grasping the walls of the sinus from which it arose with artery forceps, but were ineffectual, and the patient quickly succumbed. Post-mortem examination showed that one of the depressed fragments had opened the Torcular Herophili, the junction of the superior longitudinal and lateral sinuses.

CASE II.—H. R. Wharton. M. M.,¹ twenty-four years of age, Univer-

¹ Read before the Philadelphia Academy of Surgery, January 7, 1901.

sity Hospital, was struck on back of head by dump-car, August 30, 1886, and sustained a compound depressed fracture of the occipital bone. Trephined, and depressed bone removed by Professor Ashhurst, and when largest fragment was removed, which corresponded to the position of the junction of the lateral and superior longitudinal sinuses, there was a gush of venous blood, which was quickly controlled by packing the wound with antiseptic gauze. The patient made a good recovery. Five months afterwards the patient was admitted to the University Hospital with typhoid fever, which proved fatal. Post-mortem examination showed large gap in skull where bone had been removed, and a cicatrix in lateral sinus near its junction with the superior longitudinal sinus, and a well-organized thrombus occupying a portion of the lateral and superior longitudinal sinuses.

CASE III.—H. R. Wharton. C. M., aged thirty years, admitted to the University Hospital, 1883, under Professor Ashhurst's care, with an extensive scalp wound, and a compound depressed fracture of the posterior portion of the right parietal bone. A trephine was applied and the depressed bone was removed. Its removal was followed by free venous hæmorrhage which arose from the right lateral sinus. The bleeding was promptly arrested by packing the wound with iodoform gauze. The patient did well after the operation, and the packing was removed in a few days. The patient made a complete recovery.

CASE IV.—H. R. Wharton. J. M., aged eight years, fell into an area-way, a distance of six feet, striking upon the right side of the head, October, 1892. He was stunned for a few minutes, but regained consciousness, and walked in the house and went to his room and went to bed. I saw him a few hours after the accident, with his physician, Dr. Williams, and found that he had a large blood tumor over the right side of the skull. He was conscious and did not present any symptoms of cerebral compression. Early in the morning of the next day it was noticed that he became drowsy and did not move the left arm. I saw him again, and found that he could be aroused with difficulty, and that there was decided paralysis of the left arm and left leg. Considering it a case of hæmorrhage from the middle meningeal artery, I turned up a flap from the scalp, so as to expose the anterior inferior angle of the parietal bone, and found a fissure in the bone at this point. I applied a trephine and removed a disk of bone, but found the dura mater in contact with the bone, and no blood-clot present. I then enlarged the wound backward, following the line of the fissure in skull, and exposed an extensive depressed fracture at the posterior portion of the parietal bone. The depressed fragments were removed, and a large blood-clot, weighing four ounces, was exposed and removed. Free venous bleeding, which arose from the lateral sinus, occurred after the removal of the blood-clot, which was promptly arrested by packing the wound with iodoform gauze. The patient did well after the operation, the paralysis disappeared, and the packing was removed on the sixth day. The patient made a good recovery.

CASE V.—H. R. Wharton. A boy, aged fifteen years, was admitted to the Bryn Mawr Hospital in June, 1900, under the care of Dr. T. H. Branson, having been struck on the head by a heavy iron bucket falling from a

derrick, causing a compound depressed fracture of the right parietal bone, the line of fracture being about three inches in length.

I saw the case shortly after his admission to the hospital. He was conscious and showed no signs of paralysis, and after removing the gauze dressings, which had been freely applied over the wound to control the bleeding, I found a depressed fracture of the parietal bone, almost parallel with the longitudinal sinus, about three inches in length, and about one-half to three-quarters of an inch from the sagittal suture. The posterior portion of the depressed bone extended to the median line of the skull.

Suspecting from the position of the fracture, and from the free bleeding which had occurred, that there might be an injury to the longitudinal sinus, I made provision for the control of the bleeding by having a quantity of strips of sterilized gauze at hand, to use promptly for packing if it were needed. I removed a disk of bone at the outer edge of the line of fracture with a trephine, and, by the careful use of an elevator and forceps, removed a number of depressed fragments; when I removed a large fragment near the median line, there was a furious gush of venous blood, which was quickly controlled by introducing the gauze packing. A very large amount of gauze was introduced before the bleeding could be entirely arrested. After the bleeding had been controlled, the edges of the wound in the scalp were brought together over the packing by silkworm-gut sutures, which were secured by bow-knots, so that they could be untied subsequently for the removal of the packing.

The patient did well after the operation; at the end of a week I again etherized him, untied the sutures, and separated the edges of the wound in the scalp; after soaking the gauze with distilled water, I carefully removed the packing piece by piece. When all the gauze had been removed, it was found that there was no bleeding; after introducing gauze strips for drainage at the most dependent portion of the wound in the scalp, the wound in the scalp was closed by tying the sutures which had already been introduced.

The patient did well, and the wound was healed in a few weeks. When he began to walk, it was found that there was some paralysis of the muscles of the left leg supplied by the external popliteal nerve, constituting a well-marked "foot-drop." This condition has greatly improved, and Dr. Branson, who had charge of the case, reports recently that the improvement has been continuous, and that at the present time the paralysis does not constitute a marked disability.

CASE VI.—Guthrie.² A heavy dragoon, at the battle of Salamanca, was thrown from his horse, and struck upon the vertex of the skull. He soon became lethargic, and a tumor was observed upon the top of the head. This on being incised showed a separation of the sagittal suture, from which blood escaped. Two crowns of a trephine were applied on the twelfth day, to permit of the discharge of blood, which had been extravasated from a wound of the superior longitudinal sinus. The patient recovered.

CASE VII.—Guthrie³ reports the case of a child, Sarah R., aged four years, who was struck upon the head by a rake, one of the teeth of which

penetrated the skull near the anterior fontanelle, and opened the superior longitudinal sinus. Three or four ounces of blood escaped before the bleeding was arrested by a compress. The child developed a slight hemiplegia following the injury, but finally recovered.

CASE VIII.—Guthrie⁴ reports the case of a man who suffered from a fracture of the skull, with laceration of the superior longitudinal sinus, by the breech-pin of a gun. Free hæmorrhage occurred upon the removal of the breech-pin, and the patient succumbed to the free bleeding.

CASE IX.—Mullar.⁵ J. A., fifty-eight years of age, was admitted to the London Hospital presenting marked cerebral symptoms, and died twenty-four hours after his admission. He had received a fall, striking the head while intoxicated. Post-mortem examination showed a rupture of the straight sinus near its junction with the lateral sinus.

CASE X.—T. Longmore.⁶ Private J. D., injured by a rifle-ball, which divided the scalp and pericranium for three or four inches across the upper and back part of the skull. The ball had passed from right to left and from before backward, just anterior to the angle of the lambdoidal suture. He was rendered unconscious by the injury and never regained consciousness, and died in twenty-four hours. Post-mortem examination revealed a rupture of the superior longitudinal sinus beneath the seat of injury, and a large quantity of coagulated blood upon the surface of the brain.

CASE XI.—H. Ludlow.⁷ M. P., aged eight years, on May 10, received an injury of the head, producing a laceration of the right side of the scalp and fracture of the right parietal bone, the fracture extending upward from the squamous suture. The patient died from pyæmia, May 24, fourteen days after the injury. Post-mortem examination showed an accumulation of pus between the dura mater and the bone, and laceration of the superior longitudinal sinus, which contained blood-clot and pus.

CASE XII.—A. H. Buchanan.⁸ A woman, struck upon the vertex of the skull by flat-iron, sustaining a compound depressed fracture of the parietal bone. In removing the depressed fragments, as a portion of the internal table was removed, there was a gush of venous blood, which came from a wound of the superior longitudinal sinus, just under the sagittal suture. The bleeding was controlled by pressure with a sponge and a compress and bandage. The sponge and compress were removed in fifty-six hours, and bleeding again occurred; this was controlled by packing the wound with lint, and the patient ultimately recovered.

CASE XIII.—A. G. Reed.⁹ G. B., struck upon the head by a brick, producing a compound comminuted fracture of the cranium. In removing the fragments, a small spiculum of bone was found to have penetrated the longitudinal sinus, and free bleeding occurred upon its removal, which was controlled by packing the wound with lint. Death occurred from pyæmia on the ninth day. Post-mortem examination revealed an abscess and a small wound of the superior longitudinal sinus; the latter was occluded by a thrombus at the seat of injury.

CASE XIV.—John Adams.¹⁰ D. L., twenty-seven years of age, a sailor, was admitted to the London Hospital, having received a fracture of the

vault of the cranium by falling from the yard-arm. Examination showed a compound depressed fracture three and a half inches in length across the vertex of the skull. Attempts were made to remove the depressed bone, but were abandoned on account of the free bleeding, which arose from a wound of the superior longitudinal sinus by a fragment of the depressed bone. The bleeding was controlled by lint packing and a compress. The patient died of pyæmia on May 1. Post-mortem examination revealed a wound of the superior longitudinal sinus by a fragment of bone. Fibrous coagula were found in the sinus.

CASE XV.—T. A. Gold.¹¹ H. B., aged six years, was kicked by a horse, sustaining a compound depressed fracture of the frontal bone two inches in diameter. A trephine was applied and the fragments were removed. Upon removing one fragment, free bleeding occurred from a wound of the superior longitudinal sinus, which was controlled by pressure, and finally was arrested spontaneously. The patient made a good recovery.

CASE XVI.—W. Parcels.¹² A man aged nineteen years was struck by a piece of grindstone over the right temporal bone. He was knocked down by the blow, but soon got up and resumed his work, but in twenty minutes became sick at the stomach and vomited. He was seen some hours afterwards by the reporter, and was then in a comatose condition, and he died thirteen hours after the injury. Post-mortem examination showed marked ecchymosis of the scalp at the seat of injury, but no fracture of the skull. Upon opening the latter there was found upon the right side of the brain six or seven ounces of blood-clot, and a rupture of the lateral sinus.

CASE XVII.—Sands.¹³ Boy, thirteen years of age, sustained a fracture of the right side of the skull from a fall from a horse, August 25. When admitted to the hospital he was comatose and presented paralysis of the left side of the body. Incision of scalp revealed an extensive depressed fracture of the right temporal and parietal bone, with escape of brain tissue. The depressed fragments of bone were removed, and in accomplishing the latter purpose bleeding occurred from the superior longitudinal sinus, which was controlled by gauze packing. Consciousness did not return, and he died two hours after the operation.

CASE XVIII.—Parkes, C. T.¹⁴ B. B., twenty-seven years of age, sustained a compound depressed fracture of the skull, on June 20, from being struck by a brick. There was profuse bleeding from the wound. Examination showed a compound fracture of the right parietal bone, one and one-half inches in diameter; there was also paralysis of the left upper and lower extremity. Removal of the fragments was followed by profuse hæmorrhage, which was controlled by packing the wound with gauze and the application of a compress. On June 21 the compress and gauze were removed, and hæmorrhage occurred from a small wound in the right lateral sinus about the size of a coffee grain. The wound was closed by introducing three catgut sutures, and the wound was packed with gauze, and a compress was applied. The patient recovered with the disappearance of the paralysis, except an inability to extend the toes of the left foot.

CASE XIX.—A. H. L.,¹⁵ nineteen years of age, while sparring, received a blow upon the left side of the jaw and in a short time became unconscious, and later developed muscular spasms and Cheyne-Stokes respiration. There were clonic movements of right hand, and all four members were in a condition of tonic rigidity. Patient did not regain consciousness and died on the sixth day. Post-mortem examination revealed an effusion of blood, with a small laceration of the left lateral sinus near outer margin of temporal bone.

CASE XX.—Wm. J. Taylor.¹⁶ W. P. J., aged thirty-five years, was admitted to St. Agnes's Hospital, June 25, 1890, having sustained a wound of the scalp and a punctured fracture of the vertex of the skull, produced by a pick. The wound was large enough to admit the finger. The depressed bone was removed, and the surrounding bone cut away with rongeur forceps, exposing a wound in the superior longitudinal sinus, from which free bleeding occurred. The wound in the sinus was about one-quarter of an inch in length. The edges of the wound in the sinus were grasped with hæmostatic forceps, which effectually controlled the bleeding. The forceps were allowed to remain in position for seventy-two hours and were then removed, and the wound was packed with iodoform gauze. The patient made a good recovery, and was discharged from the hospital August 29, 1890.

CASE XXI.—W. H. A. Jacobson.¹⁷ M. K., aged forty-three years, received a blow on the head February 1, and became unconscious, and presented marked swelling of the scalp behind the right ear. He developed symptoms of compression and died February 3. Post-mortem examination revealed a large blood-clot over right side of brain, and a fracture of the outer table of the skull, which extended to the right lateral sinus. The hæmorrhage arose from injury of the lateral sinus by the fracture, which extended into the mastoid process of the temporal bone.

CASE XXII.—W. H. A. Jacobson.¹⁸ W. P. was admitted to the University College Hospital, having received a blow on the left side of the head by a bar of iron. He was unconscious on admission, and presented a wound two inches in length, situated two and one-half inches above the left mastoid. There was a fragment of bone deeply depressed, and when this was removed with an elevator, a stream of venous blood as thick as the finger gushed from the wound. Plugs of lint were introduced, which controlled the bleeding. Hæmorrhage again occurred upon the removal of the plugs of lint on the fifth day, which was controlled by packing the wound with lint. The patient died of pyæmia on the thirty-fifth day. Post-mortem examination showed a wound of the left lateral sinus not completely healed, and the sinus was filled with soft, decolorized, putrid clots. The condition of thrombosis extended into the mastoid vein.

CASE XXIII.—W. H. A. Jacobson.¹⁹ J. W. was admitted to Guy's Hospital February 13, 1875, having fallen from a horse, and sustained a contused wound of the back of the head. Upon admission he was irritable, and soon developed convulsions, and became comatose. He died February 17, four days after the injury. Post-mortem examination revealed an extensive blood-clot between the dura mater and the bone, and a fissure

of the right cerebellar fossa of the occipital bone, with a wound of the lateral sinus.

CASE XXIV.—Phelps.²⁰ A man, from a fall on sidewalk, sustained an extensive comminuted fracture of the posterior portion of the skull. Two fragments of bone were removed and one was elevated, showing a large epidural clot. The patient had hæmorrhage from the right ear, developed stupor, and general muscular rigidity, and the sixth day after the injury developed unconsciousness and frequent general convulsions, and died on the seventh day. Post-mortem examination revealed an extensive fracture of the occipital and right parietal and temporal bones. A large epidural clot was situated beneath the fracture of the occipital bone; the posterior portion of the superior longitudinal sinus was filled by a thrombus; the walls were infiltrated with blood, and there was a large, partially decomposed thrombus in Torcular Herophili, extending through the right lateral into the petrosal sinus and internal jugular vein.

CASE XXV.—C. Phelps.²¹ A female, aged thirty years, was struck upon the head by a piece of board which had fallen thirty feet. She sustained a compound fracture of the anterior and superior portion of the right parietal bone. Trephining was resorted to, and the depressed bone removed; it was found that the superior longitudinal sinus had been lacerated by a fragment of bone. The patient recovered.

CASE XXVI.—C. Phelps.²² Male, aged thirty-three years, was struck on the head with a hammer and rendered temporarily unconscious, after which he walked to the hospital. Examination revealed a compound depressed fracture of the vertex of the skull. Depressed fragments of bone were removed, leaving an opening in the skull one and one-half inches by one inch in diameter. Free hæmorrhage occurred from a large wound of the longitudinal sinus, which was controlled by gauze packing. The patient recovered.

CASE XXVII.—C. B. Nancrede²³ reports the case of a man who received a wound of the right lateral sinus by a pistol-ball which passed through the mastoid process. The patient died of pyæmia. Post-mortem examination revealed a wound of the right lateral sinus.

CASE XXVIII.—A. Genzmer²⁴ reports the case of a woman, sixty-three years of age, in whom the superior longitudinal sinus was severed in removing a large sarcoma of the dura mater which had perforated the skull in its growth. In this case air entered the sinus, and the patient became collapsed, the respiration intermittent, and she died upon the table. Post-mortem examination. The heart was opened under water, and contained many air-bubbles and frothy blood; the left heart was empty. The arteries of the lungs and the subpleural vessels were partly injected with air.

CASE XXIX.—Prescott Hewitt.²⁵ Man, aged fifty-seven years, received an injury of the head, resulting in a compound fracture of the skull, opening the lateral sinus. The patient died of repeated hæmorrhages.

CASE XXX.—Navratil.²⁶ Girl, twenty-four years of age, sustained a fracture of the skull, with perforation of the superior longitudinal sinus, with a spiculum of bone. He sutured the dorsal wound with a deep con-

tinuous suture, so that the sinus was included. During the application of the suture the bleeding was arrested by the application of a tampon. The bleeding was controlled and the patient recovered.

CASE XXXI.—Dr. J. E. Sheppard.²⁷ W., aged sixty-four years, received an accidental wound of the lateral sinus in an operation for mastoid disease. The bleeding was controlled by packing with gauze, and the patient made a good recovery.

CASE XXXII.—M. E., twenty-two years of age, received a wound of the lateral sinus in an operation for mastoid abscess. The hæmorrhage was controlled by packing the wound with gauze, and the patient recovered.

CASE XXXIII.—M. McL., aged fifty-five years. In opening a mastoid abscess in this case, the lateral sinus was injured and free bleeding occurred. The hæmorrhage was controlled by packing the wound with gauze, and the patient made a good recovery.

CASE XXXIV.—G. Luys.²⁸ Male, thirty-eight years of age, received an injury of the head in falling from an omnibus, and was admitted to the hospital in an unconscious condition. At the time of his admission there was bleeding from the right ear, the pulse was normal, and the respiration was slow and deep. Trephined over squamous portion of right temporal bone. Lateral sinus found perforated. Hæmorrhage checked by tamponing with iodoform gauze; hæmorrhage from ear also arrested by this procedure. A fracture was also found running to the base. The patient showed some improvement, but died on the fourth day. Post-mortem examination revealed a very extensive blood-clot over right side of brain, also fracture of squamous and petrous portion of temporal bone. The dura mater was torn in the neighborhood of the right cerebral fossa, extending obliquely to superior part of right lateral sinus, which was opened and gaping, a little less than a centimetre. A portion of the dura was caught in the fracture.

CASE XXXV.—Corporal W. S.,²⁹ aged twenty-one years, was wounded near Petersburg, Va., June 20, 1864, by a conoidal ball, which entered the mastoid process of the temporal bone and passed upward and backward through the occipital protuberance just above the Torcular Herophili. In its course the ball opened the superior longitudinal sinus. The patient became comatose, and died eight hours after his admission to the hospital.

CASE XXXVI.—S. W.,³⁰ aged twenty-four years, suffered from a gunshot fracture of the left parietal bone. In its course the ball severed the superior longitudinal sinus. The patient recovered with partial paralysis.

CASE XXXVII.—Cushing.³¹ A boy sustained a compound comminuted fracture of the vertex of the skull. There was extensive subconjunctival hæmorrhage with partial oculomotor paralysis, but no involvement of the seventh or eighth pair of nerves. The patient remained unconscious for three weeks, but his throat reflexes were good, and he would swallow food placed in his mouth. An incision was made and fragments of bone removed, and there was found a laceration of the longitudinal sinus. The boy made a good recovery.

CASE XXXVIII.—Hutin.³² A soldier, aged thirty-five years, received

at the battle of Jena two gunshot wounds of the head, one dividing the two external tables of the skull for a distance of five or six centimetres, the other causing a comminuted, depressed fracture of both parietal bones obliquely, from before backward and from right to left, crossing the superior longitudinal sinus. He did not lose consciousness. The patient recovered.

Forty years afterwards he received a fall, sustaining a fracture of the thigh and a wound of the chin. He developed erysipelas and pleuropneumonia, and sixteen days later a parotid abscess. He also developed a painful, cedematous, fluctuating swelling at the top of the head, at the seat of the wound of the parietal bones, which was opened under the impression that it was an abscess, and was found to contain only black blood. It was found to communicate with the superior longitudinal sinus at the site of the old wound. The cavity was tamponed with charpie, and the bleeding was permanently arrested after three days. The patient died in a few days, but presented no head symptoms. Post-mortem examination showed a spine of bone four millimetres in length and seven millimetres in width growing from the bone at the seat of fracture, which had perforated the superior longitudinal sinus; the hæmorrhage, having leaked along the dura mater, had formed the tumor of the scalp.

CASE XXXIX.—N. R. Moseley.³³ Private E. S., aged eighteen years, was wounded June 3, 1864, at the battle of Cold Harbor, Va., by a conoidal ball, which fractured the occipital bone just above the left extremity of the superior curved line. The patient presented symptoms of compression of the brain, and later became comatose. The ball was removed from the left lateral sinus and the hæmorrhage was controlled by pressure with sponges. The patient died June 18.

CASE XL.—John A. Liddell.³⁴ Private P. K., twenty-one years of age, was wounded at Middleburg, Va., on June 21, 1863, by a carbine-ball, which produced a fracture of the right parietal bone near the junction of the coronal and sagittal sutures. Five days after the injury he became comatose. He was trephined, and two fragments of depressed bone were removed,—one about one and a half inches in length by three-fourths of an inch in breadth, embracing both tables of the skull, the other being a small fragment of the inner table. Upon the removal of the fragments bleeding occurred from the superior longitudinal sinus, which was controlled by packing with lint. The patient died June 27. Post-mortem examination revealed a laceration of the dura mater, and a considerable effusion of dark blood, which came from the superior longitudinal sinus.

CASE XLI.—B. W. Allen.³⁵ Private I. S., aged nineteen years, received a gunshot fracture of the frontal bone near the anterior fontanelle. He was admitted to the hospital and trephined, and fragments of bone removed. One week after the operation he developed pyæmia, and died of hæmorrhage from the superior longitudinal sinus sixteen days after the operation of trephining. Post-mortem examination revealed ulceration of the coats of the sinus, with small spiculæ of bone resting upon it.

CASE XLII.—R. G. Le Conte. A child, two years of age, was admitted to the Methodist Hospital, having fallen from a second-story window and

struck upon its head. There was no external wound of the scalp, but a large hæmatoma. The patient was unconscious and in collapse. The scalp was incised, and the parietal bones were comminuted near the vertex; fissures extended to the bones at the base of the skull. In removing fragments of bone free hæmorrhage occurred from the superior longitudinal sinus, which was controlled by packing the wound with gauze. The patient did not react, and died in a short time.

CASE XLIII.—W. H. A. Jacobson.³⁰ Man, thirty-five years of age, was admitted to the hospital with scalp wound, November 29, 1862, in a state of insensibility. He was dressed and sent out, but was returned later by the police, who found him insensible on the street. The patient was unconscious, breathing was slow, and the pupils were moderately dilated and fixed. Died without marked change in symptoms eight hours after admission. Post-mortem examination revealed no fracture of the skull, but large blood-clot over left hemisphere of brain, under the dura; blood also entered to the right side of brain under the *crux cerebri*. A lacerated wound was found in the left lateral sinus near the middle of its highest point.

CASE XLIV.—Gangolphe and Piery.³¹ A young man, aged twenty-five years, in consequence of a fall down-stairs, suffered a fracture of the base and lateral aspect of the occipital bone, and a portion of the temporal bone. The lateral sinus was torn by divulsion, and a large hæmorrhage with resulting clot accumulated between the dura mater and the skull, compressing the brain over the anterior two-thirds of the temporal lobe and a portion of the parietal lobe behind the Rolandic zone. Subdural ecchymosis on the left side, covering the external surface and base of the left hemisphere. The symptoms were mistaken for those of apoplexy, which they resembled. There was coma, stertor, left-sided hemiplegia of the face, apparent left-sided anæsthesia, and contraction of the right arm and leg. A slight wound of the scalp, examined twice, did not extend to the bone. No fracture discovered until autopsy. Death on the fifth day.

CASE XLV.—Petit.³² A child of ten years fell from a second story to pavement, and became unconscious. No bleeding from nose, mouth, or ears. Hæmatoma developed behind right ear. The patient exhibited unconsciousness and restlessness, alternating later with delirium. Retention of urine, constipation, vomiting for first day or two. Rapid pulse, contracted pupils, extremities insensible. Later, deep coma, general insensibility, contracted and insensible pupils, limbs flaccid, slow, deep, but not stertorous respiration. Death on third day. Post-mortem examination revealed a radiating fracture of the right lateral aspect of the skull, with laceration of the lateral sinus and large epidural clot, with extravasation of blood beneath the scalp; subdural ecchymosis on the same side, and intra-arachnoid effusion on the opposite side. Contusion of the brain.

CASE XLVI.—Aran.³³ Male, aged forty-one years. A fall down-stairs on the head. Bleeding immediately from left ear, continuing for two days. Upon the third day after the injury, after two days in bed, he walked several miles, and later complained of headache and fatigue. He

became delirious, and on admission to the hospital was observed to have a swelling over parietal region in superior posterior portion, several fingers' breadths in size. The right arm and leg were paralyzed and sensibility diminished. He died in coma on fifth day. Autopsy showed separation of left posterior portion of lambdoidal suture, and fracture of temporal, extending to base of mastoid. Another fracture extended through auditory canal. Comminuted fracture of petrous portion. Fracture of glenoid cavity. Lateral sinus torn where it reaches posterior lacerated foramen. There was a large epidural clot under left parietal bone. There was also intra-arachnoid ecchymosis and contusion of the brain.

CASE XLVII.—Larry.⁴⁰ A soldier was shot behind the right ear, the ball entering at the level of the mastoid process, grooving its base, fracturing the squamous plate of the temporal, and presenting two wounds of exit, one through the antihelix, the other at the level of the zygomatic arch. There were symptoms of concussion and compression. Larry enlarged the wound and trephined for the purpose of elevating any depressed fragments. A collection of blood was evacuated through the opening from between the skull and dura, and the patient immediately improved. The symptoms of compression were considerably diminished, but the intellect was confused, and the patient was deaf on the same side and limbs relaxed. Improvement continued for a few days, when the patient on going to stool fell, and died shortly after. Post-mortem examination revealed a rupture of the right lateral sinus, effusion of bloody serum in the lateral ventricles, and on the surface of the cerebellum, and at the entrance of the spinal canal and sanguineous pus in the superior longitudinal sinus.

CASE XLVIII.—Morgagni.⁴¹ A woman fell down-stairs, striking her head. She lost the power of speech immediately, also power of feeling and movement in limbs, especially lower extremities. There was bleeding from the nose and one ear, and she died in an hour. Post-mortem examination revealed a transverse fracture of the base, involving the petrous portion of the temporal bone, crossing the sphenoidal sinus to the other side of the skull, and opening the auditory canal. The lateral sinus and dura mater were torn, and there was a large extravasation of blood at the base of the skull. The cerebellum was slightly lacerated.

CASE XLIX.—Gaignere.⁴² Injury of the lateral sinus by an iron dung-hook. Profuse hæmorrhage. Pressure bandage controlled it. Recovered.

CASE L.—Marchetti.⁴³ Injury of the superior longitudinal sinus by a foreign body which penetrated to corpus callosum. Five pounds of blood lost. Controlled by astringents. Bandages removed at end of fourteen days. No more bleeding. Healing by granulation.

CASE LI.—Lamotte.⁴⁴ Transverse wound of both parietal bones by a sabre-cut, with simultaneous injury of superior longitudinal sinus, meninges, and brain. Hæmorrhage followed by serous fluid and white flakes. Recovery in two months.

CASE LII.—Mackenzie.⁴⁵ Injury of cavernous sinus through penetration of the sphenopalatine fissure by the stem of a tobacco-pipe. No fracture or injury of brain or extravasation of blood. Patient died. Post-

mortem examination revealed disorganization of the cavernous sinus and neighboring portion of brain and dura.

CASE LIIL.—Chassaignac.⁴⁸ A man suffered from a deep penetrating wound of skull and brain, followed by loss of memory and of power on left side. Delirium, and death on seventh day. Post-mortem examination showed penetration of superior longitudinal sinus and left ventricle, which contained large quantity of serum and coagulated blood.

CASE LIV.—Broca.⁴⁷ mentions a case in Nélaton's clinic of simultaneous wound of cavernous sinus and internal carotid artery by an umbrella-stick penetrating the orbit. Result: arteriovenous aneurism.

CASE LV.—C. Bell.⁴⁹ A workman, aged sixty-three years, while pushing a heavy wheelbarrow after eating a hearty meal, suddenly became unconscious and fell, and after a deep inspiration died. Post-mortem examination revealed a rupture of the right lateral sinus, with an effusion of ten ounces of black and fluid blood into the arachnoid, covering the right hemisphere and the base of the brain. The walls of the sinus were thin and atrophic, and in the middle of the sinus there was an irregular tear. There was no fracture of the skull.

CASE LVI.—Schmucker.⁵⁰ Soldier, wounded by hand grenade, twice trephined, died on eighteenth day. Splintering of inner table, with one splinter penetrating the superior longitudinal sinus. In the sinus were found blood-clots and a mixture of blood and pus, and the walls covered and the posterior portion filled with granulations.

CASE LVII.—Chassaignac.⁵⁰ Case was struck on back part of head, skull fractured, and Torcular Herophili torn. Delirium. Death after a few days without symptoms of compression. Extravasation outside dura.

CASE LVIII.—Volmer.⁵¹ A fifteen-year-old boy fell fifteen feet, striking back part of his head on the firm floor. He was stunned, and died in convulsions on the same day. Post-mortem examination revealed no fracture, but a tear several lines in length in the middle of the right lateral sinus. Blood extravasated around cerebellum and into inferior occipital fossa in large quantity, partly coagulated.

CASE LIX.—Boinet.⁵² A forty-one-year-old male fell down-stairs while intoxicated and bled freely from left ear. No other symptoms. He felt so well that he walked three miles. After return felt fatigued and ill, complained of headache, fever, later delirium. On the second day there developed stertorous respiration, followed by coma, and death the fourth day after the accident. Post-mortem examination revealed a fracture of the left petrous portion of the temporal bone, extending into glenoid cavity; left lateral sinus widely opened at its point of termination in posterior lacerated foramen.

CASE LX.—Hedlund.⁵³ A farm-hand, twenty-seven years old, stumbled over a door-sill, fell over backward, and died in a short time. Post-mortem examination revealed no fracture of the skull. A long bony spiculum, four inches long, one-half inch wide, one-half inch thick, and weighing 190 grains, projected into the superior longitudinal sinus, which was torn throughout the corresponding distance. Whole brain covered with blood. Hedlund considered that the wall of the sinus had been gradu-

ally thinned by the pressure of the spine of bone, and the slight shock sustained in falling had torn it.

CASE LXI.—Gama.⁵⁴ A patient had superior longitudinal sinus torn by a depressed splinter of bone, large opening. Recovered under simple compression dressing.

CASE LXII.—Pott.⁵⁵ This surgeon opened the superior longitudinal sinus with a lancet in a girl aged sixteen years, who had a comminuted fracture of the skull. After removing the splinters, and thus laying bare the sinus, he bled the patient therefrom until she recovered consciousness. A charpie compress held with the finger for some time checked the bleeding. There was marked improvement of the condition, but death later from abscess formation on the upper surface of the brain.

CASE LXIII.—Pott.⁵⁶ An eight-year-old boy who, after a blow with a stick upon the vertex, developed a painless, fluctuating, and pulsating swelling the size of a walnut, which when opened gave exit to a flow of blood from its depths. Investigation showed a fracture over the sagittal suture and a fragment penetrating the superior longitudinal sinus. He was trephined, the fragment removed, hæmorrhage checked by a few minutes' compression with a charpie compress, and the patient recovered.

CASE LXIV.—Warner.⁵⁷ A thirteen-year-old boy received a severe blow upon the head, causing a depressed fracture of both parietal bones. Temporary unconsciousness. On the sixth day convulsions, vomiting, paralysis of the left side, double vision in right eye, left unaffected. On the eleventh day trephined and depressed fragments removed, and a wound of the superior longitudinal sinus by a splinter discovered, the splinter still in the wound. Its removal was followed by severe hæmorrhage, controlled by dressing. Improved for four weeks, then developed symptoms of compression and died of abscess of the brain.

CASE LXV.—Wharrie⁵⁸ reports the case of a man who, in consequence of being knocked down by blows by the fist, immediately expired. He suffered from a rupture of the right lateral sinus, with extravasation of blood into the lateral ventricles and upon the base, and with great congestion of the vessels of the upper surface of the brain. Externally there was only an insignificant contused wound.

CASE LXVI.—Phelps.⁵⁹ Patient admitted to hospital unconscious, pupils contracted, skin cold and moist, bleeding from both nostrils, large hæmatoma in right frontoparietal region. Linear fracture discovered by incision. Death occurred in two and one-half days. Post-mortem examination disclosed a large hæmatoma over vertex of skull; separation of coronal suture and fissure in right parietal bone extending from it; large epidural clot over left parietal region, and another over right frontal region; superior longitudinal sinus filled with a firm blood-clot; epidural clot in left middle fossa; rupture of superior longitudinal sinus, with large pial hæmorrhage over left frontal, temporal, and parietal lobes.

CASE LXVII.—R. G. Le Conte. J. E., aged thirty-eight years, Italian, struck by falling lumber on crown of head. Both parietals fractured, and depressed area over two inches in extent. Great damage to inner table, with many small spicules of bone. Superior longitudinal sinus perforated

in seven places by these small spicules. Sutures used (fine silk) to close openings, then packed over with gauze. Shock very great. Three quarts of salt solution intravenously injected. Did not react, and died in two and a half hours.

CASE LXVIII.—R. G. Le Conte. R. G., aged seventeen years, roofer, Germany. Cause of injury unknown, as he was found unconscious in a building undergoing construction. Fracture of skull, with depressed fragments over left parietal bone; area about two and a half by one and a half inches. Superior longitudinal sinus perforated by a fragment; controlled by packing. Part of packing removed in forty-eight hours, and remainder twenty-four hours later. No further hæmorrhage. Case doing well, but still has marked aphasia, two weeks after the injury.

CASE LXIX.—Brodie.⁶⁰ A boy who received an injury of the head and died shortly after the accident. Post-mortem examination showed fracture of the base of the cranium, with laceration of the cavernous sinus, from which the hæmorrhage had occurred.

CASE LXX.—Bergmann⁶¹ reports the case of a man, whose occiput was badly injured by a blow on the back of the head, who on admission to the hospital was bleeding from the nose and mouth, and died in four hours. Post-mortem examination revealed œdema of both lungs and air embolism, the air probably entering through the injured longitudinal sinus at the Torcular Herophili at the seat of injury.

Wounds of the venous sinuses of the brain are of comparatively infrequent occurrence, which may in a measure be accounted for by the anatomical peculiarities of these venous channels; they are enclosed in a firm bony case, and their external walls are continuous with the dura mater. Their lining membrane is that of the veins; they are also closely attached to the cranial bones. It is only in exceptional cases that the sinuses are wounded unless the cranium has been fractured. The only sinus which is accessible to direct violence without fracture of the skull is the cavernous sinus, which can be reached by small objects without fracture of the cranial bones by way of the orbit and the sphenoidal fissure, and is the sinus which is most infrequently injured.

In looking over the literature of injuries of the venous sinuses of the brain, I have been surprised to find that comparatively few cases have been recorded. This is remarkable when we consider the great interest which has always been attached to injuries of the head and its contents, and the amount of work which has been expended in recording and

studying this class of injuries. It is to be accounted for possibly by the fact that in many cases of serious injury of the brain the symptoms presented were considered due to lesions of that organ itself, and the lesions of the venous sinuses, being thought to be of minor importance, were overlooked or not recorded.

Causes of Wounds of the Venous Sinuses.—Wounds of the venous sinuses of the brain most frequently result from direct injury to their walls by fragments of bone in depressed fractures of the skull, the sharp edges of the fragments frequently tearing the walls of the sinuses, but may also occur from the impact of foreign bodies, as the result of gunshot injuries and from divulsion of the bones of the skull, and they may also be torn or incised in operations upon the brain. These injuries may also occur in infants during birth. Litzmann⁶² has twice observed rupture of the superior longitudinal sinus in cases of a narrow, flat pelvis, with the promontory of the sacrum so arranged as to make deep pressure upon the side of the head, in consequence of which the sagittal border of the parietal bone pierced its coverings and opened the superior longitudinal sinus.

Laceration of the venous sinuses of the brain may also result from force transmitted through the bones of the skull without fracture.

Duchame-Moncharmant⁶³ investigated the resistance of the venous sinuses to traction, and found it less in children under twelve years of age.

Comparative Frequency of Injury of Special Sinuses.—It is also interesting to study the injuries of the special sinuses as regards their frequency. In this collection of seventy cases the superior longitudinal sinus was injured in forty cases, the lateral sinus in twenty-five cases, the cavernous sinus in three cases, the straight sinus in one case. Bergmann mentions two cases of rupture of the transverse sinus which are not included in this collection, and says that this sinus is liable to rupture when the force is applied from above and behind, as the result of which the skull is compressed in a downward direction.

It will be observed that in this collection of cases of injuries of the venous sinuses of the brain the longitudinal sinus was most frequently injured, and next in frequency the lateral sinus, and that the cavernous, straight, and transverse sinuses were rarely injured. It should be noted, however, that considerable difference of opinion exists among different observers as to the comparative frequency of injury of the various sinuses. Prescott Hewitt⁶⁴ thinks that the lateral sinus is more frequently injured than any of the other sinuses of the brain. Agnew⁶⁵ states that the superior longitudinal sinus is the one most frequently injured. Phelps⁶⁶ considers wounds of the superior longitudinal sinus most frequent. The superior longitudinal sinus from its position is more liable to injuries by direct violence, and is frequently injured by fragments of bone in fractures of the parietal bones and by foreign bodies penetrating these bones. The lateral sinuses appear to be more liable to injury by transmitted force than the superior longitudinal sinus; they are also infrequently penetrated by fragments of bone, but are sometimes torn by divulsion of the bone in fractures.

Gangolphe and Piery⁶⁷ present some interesting observations upon wounds of the various sinuses. They find that the rigidity, inelasticity, and close adherence of the walls of the lateral sinus to the bony walls of the skull render it liable to tears and to injury by fragments of bone in fractures, prevents its collapse when wounded, and precludes the chance of the spontaneous arrest of hæmorrhage. It is by its position readily accessible to injuries, being included with the superior longitudinal sinus and the Torcular Herophili in Gerard Marchants' Classification of *accessible sinuses*, as opposed to the others,—the *inaccessible*, which, though not entirely free from the risk of injury, are only exceptionally injured by traumatisms. The sinuses can be injured in two ways,—by foreign bodies and fragments of bone tearing it, and by rupture by disjunction of fragments in fractures of the cranial bones.

Duchame-Moncharmant and Carle conducted experiments upon skulls as to the liability of the lateral sinus to rupture by

disjunction, and found that lesions were comparatively rare. Chipault, in thirty cases of rupture of the venous sinuses of the brain, states that only four were of the lateral sinus. G. Marchant explains the relative immunity of the lateral sinus to the fact that in the occipital bone the two tables are separated by a thick layer of spongy bone, not easily splintered when fractured.

Wounds of the cavernous, transverse, straight, circular, and petrosal sinuses appear to be very infrequent. Wounds of the cavernous sinus which do not prove immediately fatal from hæmorrhage are apt to result in the development of arterio-venous aneurism. It is probable that these sinuses are frequently injured in cases in which there has been extensive disorganization of the cerebral tissues, and that the sinus lesions have been overlooked in the presence of graver lesions of the brain.

Prognosis.—In the preceding collection of cases of wounds of the venous sinuses, recovery followed in twenty-five, —35.7 per cent. of the cases,—and death in forty-five,—64.3 per cent. of the cases. In forty cases of wounds of the superior longitudinal sinus recovery occurred in sixteen cases, 40 per cent., and death in twenty-four cases, 60 per cent.

In twenty-six cases of wounds of the lateral sinus recovery followed in eight cases, 30.7 per cent., and death in eighteen cases, 69.3 per cent.

In three cases of wounds of the cavernous sinus recovery occurred in one case, 33.3 per cent., and death in two cases, 66.7 per cent.

In one case of injury of the straight sinus death resulted.

In view of the high mortality which has been shown to follow wounds of the venous sinuses of the brain, it is difficult to understand why many of the older writers considered these injuries not of a serious character. Brodie⁶⁸ says that wounds of the venous sinuses bleed profusely when there is a free opening in the bone made by accident or operation through which the blood can readily escape, but very slight pressure is adequate to the suppression of this as well as other venous

hæmorrhage. He also says: "I have never known of a case when such a collection of blood, in consequence of a wounded sinus, between the dura mater and the bone, or between the dura mater and the brain, was capable of interfering with the function of the brain." Hennen⁶⁹ mentions a case of wound of the superior longitudinal sinus from a sabre-cut, which bled profusely without producing fatal consequences, and remarks that he had seen the superior longitudinal sinus opened by splinters of bone, but had never seen anything approaching dangerous hæmorrhage from it; in truth, he considered bleeding from wounds of the head one principal source of the patient's safety.

Guthrie⁷⁰ says that a wound of the longitudinal or lateral sinus which permits of a free discharge of the blood poured out is of little comparative consequence; but it is, on the contrary, a very fatal injury when the blood is permitted to accumulate.

Pott, in a case of compound fracture of the skull, after removing the fragments of bone, which exposed the superior longitudinal sinus, intentionally opened the sinus and allowed a quantity of blood to escape, afterwards controlling the bleeding by pressure. This patient subsequently died of abscess of the brain.

M. Serres⁷¹ opened the superior longitudinal sinus in animals, and found that a large quantity of blood might be allowed to spread itself slowly over the surface of the brain without causing a loss of motion or sensation. This is accounted for by this observer by the fact that the blood from the veins and sinuses of the head flows more slowly and is more fluid and less coagulable than that from the arteries, and to the capability of the brain to bear pressure which is slowly and equably spread over it, while it is not able to resist a pressure that is more direct and more rapidly effected.

As has been stated, many of the older writers were inclined to consider wounds of the venous sinuses of the brain as not of a serious character. There are, however, certain risks in these injuries which cannot be overlooked. The first is hæmorrhage. Blood may escape from an external

wound and quickly exsanguinate the patient. Death resulted from this cause in seven cases in this collection. Blood may also escape from a wounded sinus and collect between the dura mater and the skull, thereby diminishing the capacity of the cranial cavity and causing mechanical compression of the brain, with the consequent changes in the circulation and nutrition of the organ which accompany this condition, and producing slowly or rapidly developing symptoms of compression of the brain. Blood may also accumulate beneath the dura mater. Intracranial hæmorrhage, more or less extensive, was present in twenty-six of the fatal cases.

In extensive wounds of the sinus the hæmorrhage is profuse; and if it does not escape from the wound, the blood accumulates slowly within the skull and soon produces marked symptoms of compression of the brain. On the other hand, if the wound in the sinus is small the amount of blood extravasated may be small, and it may be largely absorbed, leaving only a mass of fibrous tissue at the seat of injury. If the wound of the sinus be due to a fragment of bone or foreign body which has penetrated the sinus and remains impacted, the hæmorrhage may be insignificant, but upon removal of the fragment or foreign body profuse hæmorrhage may occur, which may prove fatal unless promptly controlled. It is possible in such cases to have recovery take place without removal of the fragment if the injuring body does not produce infection of the sinus, a limited thrombosis of the sinus resulting, for it has been shown that a partial occlusion of the sinus may exist without marked disturbance of the functions of the brain.

The greatest danger in wounds of the sinuses of the brain is from septic infection. In the present collection of cases a large number died of pyæmia and abscess of the brain. This cause of death is more frequently noticed among the cases reported before the introduction of the antiseptic method of wound treatment. Many cases of sinus wounds were complicated with injuries of the brain, and death in these cases resulted from cerebral hæmorrhage combined with that from the

wounded sinus, giving rise to general symptoms of compression of the brain.

Air embolus is an occasional cause of death, causing the fatal termination in at least two of the cases, reported by Genzmer and Bergmann, and may have been overlooked in some others.

The case reported by Genzmer, as well as his experiments, is of especial interest in this connection.

Genzmer records a case in which the superior longitudinal sinus was severed during an operation for removal of a large sarcoma of the dura mater, which had perforated the skull in its growth. The patient was a woman, aged sixty-three years, and the tumor was situated at the posterior end of the sagittal suture. The operation was performed by Volkmann. After turning down the skin-flaps, the opening in the skull was enlarged around the base of the tumor, the attachments to the surrounding dura from which it sprung were severed, and the tumor was then lifted up, and its remaining connection with the falx cerebri attacked with scissors. As the blood was sponged away in great haste, and the field of operation was momentarily visible, they suddenly heard the characteristic lapping noise, and the same instant the anæsthetizer who was administering the chloroform called out, "She is dying." The patient went into collapse, with snoring and intermittent respiration. The operation was completed; when the tumor was lifted and the last connections severed about the attachment of the longitudinal and transverse sinuses, and the field of operation sponged dry, the same sound was heard. The patient was pulseless, pupils dilated, barely reacting, extremities blue and cold. After bandaging arms and legs the pulse was perceptible for a short time; breathing continued, becoming more intermittent; consciousness did not return, and the patient soon died.

Autopsy confirmed the view that death was due to air embolism, as, when the right heart was opened under water, it contained many bubbles and frothy blood. The left heart was empty. The arteries of the lungs and subpleural vessels were partly injected with air. The inner organs were anæmic, but not excessively so. The longitudinal sinus was found to communicate with the wound in the dura and another very large vein of the skull.

Genzmer does not know of any other case in the literature in man, but Bernard has observed it in animals, when after opening the longitudinal sinus air was observed to find its way through the vertebral veins and vena azygos into the right heart.

Genzmer experimented on nine dogs, and in six of them observed the entrance of air into the circulation after opening of the longitudinal sinus. In two of the cases in which it was not observed, the animals had been tracheotomized, which lowered the negative pressure in the thorax, as the air easily found its way in. In all three the blood-stream soon ceased to pulsate with the breathing, and a clot was found after death in the central part of the sinus. Death occurred much sooner in the animals in whom air was found in the heart. Strong and dyspnœic breathing increased the risk of entrance, as did free bleeding, by lowering the positive blood-pressure. By sponging away the blood, air entrance was favored. Therefore, in operating on such cases, we must see (1) that the blood-pressure is not too much reduced; if much hæmorrhage is expected, before opening the sinus the patient's limbs may be bandaged, to raise the blood-pressure. (2) That the patient makes no forcible inspiratory movements; use deep narcosis. (3) That the wound in the sinus is kept covered with a layer of fluid; therefore do not sponge away the blood, and also irrigate with salt solution.

Repair of Wounded Venous Sinuses.—Wounds of the sinuses may heal without obliteration of the canal, or there may be partial obliteration, diminishing the capacity of the sinus at the point of injury. A thrombus may form at the seat of injury in the wall of the sinus and extend so as to completely occlude the sinus, often extending from the superior longitudinal to the lateral sinus. If this thrombus be non-infective, it appears to have little effect upon the functions of the brain, which is to be explained by the free intercommunication of the various sinuses. Obliteration of the largest sinus has been observed, with little variation in the functions of the brain.

Symptoms.—The symptoms which indicate a large extravasation of blood within the cranial cavity from a wound of one of the venous sinuses of the brain are not definite as regards the source of the bleeding, and are simply those of intracranial hæmorrhage. The symptoms are often indistinguishable from those arising from injuries of the meningeal vessels and from apoplexy, with the possible distinction that in bleeding from sinus wounds compression symptoms are apt to develop more slowly. It should also be noted that wounds of the sinuses are often associated with laceration and contusion of the brain itself, and complicated symptoms arising from both of these injuries may exist at the same time. If the pial veins are torn in conjunction with the sinus, the blood accumulates under the dura mater, and compression symptoms from intracranial hæmorrhage may develop earlier than in uncomplicated wounds of the sinuses. Unconsciousness is a very constant symptom in fatal cases, and comes on later in wounds of the venous sinuses than in wounds of the meningeal arteries.

Marchant,⁷² from his investigations upon wounds of the lateral sinus, concludes that the symptomatology is very variable, and that rarely can the source of the hæmorrhage be diagnosed before operation; the presence of some form of intracranial hæmorrhage causing compression of the brain is all that can usually be determined upon, and even this not always clearly. The symptoms may be those of cerebral apoplexy, as in one case he reported.

Diagnosis.—The diagnosis of wounds of the sinuses of the brain is often a matter of difficulty, from the fact that the symptoms presented are often similar to those resulting from lesions of the arteries of the meninges and of the brain. In wounds of the sinus in which there is an external wound, the location of this wound and the character of the blood which escapes will often assist in making a correct diagnosis. The most difficult cases are those in which a sinus wound exists without an external wound. In doubtful cases, when the diagnosis lies between apoplexy and lesions due to traumatism, the

decision as regards treatment should be in favor of the latter. In cases without distinct localizing symptoms, the comparative greater frequency of wounds of the meningeal arteries following traumatisms should be borne in mind, and may be of value in forming a diagnosis.

Chipault,⁷³ in 117 cases of intracranial hæmorrhage, records seventy-two cases from injury of the middle meningeal artery, and thirty cases of wounds of the venous sinuses. Treves⁷⁴ says that intracranial hæmorrhage in from 80 to 85 per cent. of the cases arises from wounds of the meningeal arteries, and that in about 15 per cent. to 20 per cent. of the cases it arises from wounds of the venous sinuses of the brain. Phelps⁷⁵ records 300 injuries of the brain and membranes, and in this collection there are mentioned only four cases of wounds of the venous sinuses.

The diagnosis of wounds of the sinuses of the brain must therefore be made largely upon the site of the injury, the character of the blood which escapes, and in cases in which no external wound exists, by the slower development of the symptoms of cerebral compression.

Treatment.—In the majority of cases of wounds of the venous sinuses of the brain, when the wounded sinus is open to inspection through a wound in the scalp, and a fracture of the skull, the treatment is not a matter of difficulty; but in cases where these conditions do not exist, their treatment is attended with great difficulty. In cases of sinus injury without fracture of the skull, a trephine should be applied, and the bone removed by rongeur forceps to a sufficient extent to expose freely the injured portion of the sinus. The recommendation of Gangolphe and Piery in such cases, that the trephine be applied at the point of traumatism rather than at the point indicated by the symptoms, which may be misleading, I think is sound and should be followed. After exposing the wound in the sinus, the bleeding should be controlled by some of the various methods of treatment. The observance of the greatest care as regards asepsis cannot be too strongly urged in connection with the treatment of wounds of the venous sinuses,

for infection of these channels is always followed by fatal results.

In view of the high mortality which follows wounds of the venous sinuses of the brain, it is a matter of interest to study the different methods of treatment which have been at various times recommended to control the bleeding, and if possible to determine that method which has been followed by the best results. The methods of treatment which have been most employed are pressure by compress or gauze packing, ligation of the sinus, the lateral ligature, suture, and forceps pressure.

Gauze Packing.—The most widely employed method, and the one which seems to be the most generally applicable, is gauze packing. The results from this method of treatment have been most satisfactory, and the unfavorable results only have occurred in the cases reported before the introduction of modern methods of wound treatment, when material which was not aseptic was used as the packing material, and the wounds later became infected. It is in cases of depressed fractures of the skull, with wounds of the sinuses by the fragments of bone, that the most alarming hæmorrhage is apt to occur upon the removal of the fragments. Where depressed fragments of the skull occupy a position near any of the large venous sinuses, it is well to bear in mind the possibility of a sinus wound, and be prepared to control hæmorrhage if it occurs. This complication should be considered in cases which present symptoms of intracranial hæmorrhage, as well as in those which do not present such symptoms, for often the intracranial bleeding is insignificant, as the fragment of bone which has produced the wound in the sinus plugs it; and it is only when the latter is removed that dangerous bleeding occurs.

If the wound in the skull be a small one, it is well to enlarge the opening either with a trephine or rongeur forceps before the depressed fragments are removed, so that sufficient space may be afforded to expose the injured portion of the sinus and permit of the satisfactory application of the packing to control the bleeding.

The material which has been found most satisfactory for

packing is iodoform or sterilized gauze, which should be used in strips two or three inches in width. This is introduced with a director or elevator until a sufficient quantity has been applied to arrest the bleeding, and a gauze dressing is applied over the packing and held in place by a bandage. In other cases it may be advisable to close the wound in the scalp over the packing with interrupted sutures, to hold it more securely; the latter being secured by bow-knots so that they can be untied when the packing is finally removed, and again secured, thus obviating the necessity of a second introduction of the sutures. The packing should be allowed to remain in position for three to six days; after this time its removal is usually not followed by bleeding, and the wound can then be closed. The only disadvantage of this method of packing in these cases is that the wound is practically an open one for some days, and may prove an avenue of infection unless the greatest care is observed to prevent its occurrence. The prompt and complete control of dangerous bleeding by this method of treatment cannot fail to recommend it.

Ligation.—Ligation of injured venous sinuses has been recommended and practised with satisfactory results in some cases, and the complete occlusion of the sinus appears to have had little effect upon the functions of the brain. Ligatures do not appear to have been often used in controlling hæmorrhage from ordinary wounds of the venous sinuses, but seem principally to have been resorted to as a preliminary step in removing growths of the brain, or in accidental wounds produced in the removal of such growths. They have also been frequently employed in cases of operations upon the sinus for infective thrombosis. Kammerer ligated the longitudinal sinus an inch above the Torcular Herophili in an operation for removal of a sarcoma involving the dura mater above the sinus. Bergmann, Küster, and Navratil have also recorded cases in which they ligated the venous sinuses in operations upon the brain.

It is a difficult matter to pass a ligature around the longitudinal or lateral sinus unless the dura mater is freely incised

on each side of the sinus. In passing the ligature, the sinus itself may be punctured, or the vessels of the pia mater or the tissue of the brain lacerated, unless the operator has a very free exposure of the seat of operation, which is not often present in the ordinary accidental wounds. In applying a ligature to a venous sinus, great care should be taken not to injure the veins of the pia mater, as the blood-current is maintained through them after occlusion of the sinus. Stratton⁷⁶ directs attention to the difficulties and dangers of ligation of the venous sinuses, and confirmed his observations by experiments upon the cadaver. He says, "The sinus may be lacerated as the ligature is drawn taut, or pressure upon the cerebral tissues may be produced by great tension upon the dura, depressing it below its normal position. If relaxation of the membrane does not exist, as the ligature is drawn tight the dura, falx or tentorium—if the lateral sinus is being operated upon—must tear sufficiently and in such a direction as to permit easy and safe approximation of its walls. If, coincidently with the tightening of the ligature, the dura could be incised, thereby cerebral pressure and laceration of the sinus might be avoided; even after tying the ligature incisions of the dura would relieve pressure upon the cortex by that membrane. Puncture of the pial vessels, which at their junction with the sinuses are of considerable size, may give rise to a fatal subdural extravasation of blood." He found in an experimental ligation of the superior longitudinal sinus upon the cadaver that no laceration of the sinus had occurred, and only a slight tear of the dura mater was present, but the dura was locally in a state of great tension, and was depressed beneath the inner surface of the skull for a considerable distance beyond either border of the opening in the bone.

Macewen recommends, it seems to me, a much safer procedure than ligation, which consists in a separation of the outer wall of the sinus from the skull, pressing it inward into the sinus, and tamponing the intervening space with gauze.

Lateral Ligature.—This procedure, which is very satisfactory in controlling hæmorrhage from small wounds of the

larger veins, would seem to be an ideal one in similar wounds of the venous sinuses of the brain. The successful application of such a ligature would require free exposure of the sinus, so that the size and site of the wound could be accurately determined before it could be grasped by forceps and the ligature applied. This form of ligature seems to me to be only applicable to small wounds, and is not to be recommended in large wounds on account of the inelasticity of the walls of the sinus. I have not been able to discover that this method of ligature has been employed in wounds of the venous sinuses of the brain.

Suture.—Suture of wounds of the venous sinuses by silk or catgut has been employed in a few cases with good results. This procedure was employed successfully by Navratil and Parkes in two cases in this collection, and by Le Conte in one case which proved fatal from other causes. It seems only applicable to small wounds of the sinus in which there is not profuse hæmorrhage, or, if in larger ones, in those in which there is a sufficient exposure of the sinus wall to permit of the control of the bleeding during its application by pressure upon either side of the wound.

The great advantage of the ligature, the lateral ligature and sutures in wounds of the sinuses, in addition to the control of the bleeding, rests in the fact that after their use the wound in the scalp can be immediately closed, thus diminishing the risk of infection.

Forceps Pressure.—This method of controlling bleeding from the larger veins has also been employed in wounds of the sinus in a few cases, and consists in grasping the wound of the sinus with hæmostatic forceps, and in allowing them to remain in position for two or three days. Dennis, W. J. Taylor, and Stratton have recorded successful cases following this procedure. Stratton, in excising a sarcoma of the dura mater, removed the growth with a portion of the longitudinal sinus, controlled the bleeding by clamps which were allowed to remain for three days, and there was no hæmorrhage after their removal, the patient dying on the twelfth day from other

causes. The method has the disadvantage of keeping the wound open, and thus incurring the risk of infection. Personally, I have always considered the procedure a dangerous one, in view of the fact that a patient with an injury of a sinus may develop brain symptoms, rendering it difficult to restrain him, and his uncontrollable movements may cause the forceps to inflict serious injury upon the cerebral tissues.

CONCLUSIONS.

(1) Wounds of the venous sinuses of the brain should be classed as dangerous injuries, being followed by a high mortality, from external or intracranial hæmorrhage or septic infection.

(2) They are especially liable to infection, resulting in septic thrombus and pyæmia, therefore the greatest care should be taken to render them aseptic and preserve them in that condition.

(3) The most satisfactory and generally available method of treatment consists in controlling the bleeding by aseptic gauze packing.

(4) Ligation of the venous sinuses presents definite dangers in itself, is only available in certain wounds, where a free exposure of the injured sinus is possible, and cannot be employed with advantage in ordinary accidental wounds of the sinuses.

(5) The application of a lateral ligature to a wound of a sinus is less difficult and dangerous than ligation of the sinus, but is only applicable to small wounds.

(6) Suture of sinus wounds is a valuable procedure in a certain class of cases, namely, small wounds which can be freely exposed.

(7) Forceps pressure is also a ready method of controlling hæmorrhage from wounds of the sinuses, but possesses no distinct advantages over some of the other methods, and its employment is accompanied by certain dangers.

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SPLENECTOMY IN SPLENIC ANÆMIA OR PRIMARY SPLENOMEGALY.¹

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At present little is actually known concerning the physiology and pathology of the spleen. All cases therefore, which may possibly aid in the elucidation of either or both of these subjects, should be carefully studied and placed on record. The cases which form the basis of this contribution will be given in detail first.

CASE I.—Miss E. O., twenty-two years of age, born in Chicago of Swedish parents. The family history throws no light on this case. The father and mother, two sisters and one brother are living and in good health. One sister died of convulsions at the age of three years. There is no history of tuberculosis or malignant disease in the family.

When about six or seven years of age she had measles and a very mild attack of diphtheria. At eleven she had quite a severe fall from a swing. She was perfectly well thereafter until about the age of thirteen years, when she felt a sense of discomfort about the stomach, and accidentally discovered a tumor in the left side of the abdomen. She told her mother about it, but she thought it would disappear, and nothing was done.

Some six months after she discovered the tumor she had a severe sick spell lasting nearly three months. This was diagnosed by her physician as typhoid fever; but there may be some question regarding the correctness of this diagnosis, as the course of the disease, if typhoid, was very atypical.

The illness began with profuse hæmatemesis. There was pain in the

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abdomen with distention and fever, but at no time was there any disturbance of the bowels. During the course of the disease, which, as stated, lasted about three months, there were two other hæmorrhages from the stomach, neither of which, however, was as profuse as the first.

Some four months after getting up from this sickness, or at the age of fourteen, she was brought to the surgical clinic of Dr. Harris at the Policlinic on account of the tumor in the left side. The tumor was recognized as an enlarged spleen and a blood examination made. As the case was an out-patient, no record of the blood examination was kept.

There was no leucocytosis, however, and, after excluding leukæmia and other known causes of splenic enlargement, a diagnosis of idiopathic enlargement of the spleen was made. She was given arsenic, and improved much in general health. She was seen at intervals for about two years, then disappeared from view, the splenic enlargement remaining about the same.

At fifteen she went to work in a store. At sixteen she had another hæmorrhage from the stomach, and was off work for a time. Menstruation began at the age of seventeen, and continued in a regular and normal manner. From this time on her general health gradually failed. She became pale, reduced in flesh, and so weak that at times she was unable to continue her work.

In February or March, 1899, she had an acute illness lasting from two to three weeks, and marked by fever, severe pain in the region of the spleen, distention of the abdomen with tenderness, particularly throughout the upper part. It is probable that at this time the infarct in the spleen and the adhesions to the omentum, subsequently to be mentioned, occurred.

In May she again applied to Dr. Harris. At this time she was quite weak and unable to work. The face appeared full and puffed, but the extremities were thin and the general weight reduced. The spleen extended from the seventh rib to a little below the crest of the ilium and about two to three centimetres to the right of the mid-line below the umbilicus. The characteristic notch in the border was easily felt. A brownish pigmentation was noted throughout the skin. This was marked about the face, neck, forearms, and particularly so over the abdomen about the umbilicus and extending down to the pubes. The skin of the abdomen had a distinctly mottled appearance. No pigmentation was noted about the gums or interior of the cheeks. No enlargement of any of the lymph-glands could be felt. The bowels were regular and the appetite, as a rule, good. The urine was amber in color, sp. gr. 1016; acid; no albumen; no sugar; microscopic examination negative. Blood examination showed:

Hæmoglobin (Fleischl)	40 per cent.
Red blood-cells	2,631,000
Leucocytes	2650
Color index	0.70
No plasmodium.	

A differential count of the leucocytes was not made at this time. The pulse varied from 90 to 100; temperature, 98.6° F., and respiration, 24.

The case was now recognized as one of so-called splenic anæmia or primary splenomegaly, and splenectomy was advised as a curative measure. The patient readily consented to the operation, and the spleen was removed through a median incision, May 25, 1899. This spleen is minutely described later. The patient made an uninterrupted recovery. The blood count following the operation is of interest. At the end of the first twenty-four hours there were:

Reds	4,037,000
Whites	23,600

This increase in the number of red cells is probably only apparent, and due in part at least to the withdrawal of fluids as, during the first twenty-four hours, she was unable to take anything by the stomach, and the salt solution injected into the bowel was not retained. While this may partly explain the 50 per cent. increase in the red cells, it cannot explain the enormous increase in the leucocytes, amounting as it did to nearly 800 per cent. At the end of the second twenty-four hours, during which the patient took much fluid, there were:

Reds	2,800,000
Whites	15,000

Third twenty-four hours:

Reds	2,780,000
Whites	11,560

From now on the reds slightly increased, while the whites steadily decreased in number, so at the end of seventeen days there were:

Reds	3,250,000
Whites	5688

The urine was examined daily. For the first three days there seemed to be an absolute increase in the amount of the urea eliminated. The urea amounted to 22.3 grammes, while normally, according to her weight, there should have been but 18.4 grammes. By the sixth day the urea had dropped to twelve grammes, and remained at about that amount thereafter. At the end of thirty hours the temperature had reached 103.8° F. and the respiration 41, although the pulse remained at 100, just where it was before the operation. She continued to have a temperature varying from 99° to 101°, occasionally 102°, for about two weeks, when it gradually subsided. No local conditions could be found to account for the temperature, and the patient felt well.

Jonnesco (*Archiv für klinische Chirurgie*, Band lv, S. 330) says he has noticed elevation of temperature immediately after his splenectomies

which he attributed sometimes to pulmonary congestion. At other times no lesions were apparent, and he then thought it due to a reawakening of malaria in the system. My patient had never had malaria, and the cause of the temperature therefore must remain unknown. The patient left the hospital June 19 in good condition.

The subsequent history of this case is as follows: After leaving the hospital she continued to improve, and gained about twenty-five pounds in weight. September 1, she resumed her work. October 1, she began feeling badly about the stomach, especially after eating. After a few days she had considerable pain in the region of the stomach and vomited quite a little blood. She was obliged to take to her bed. The pains and vomiting continued for several days, but after the first day there was no longer any blood in the vomit. There was considerable gas formation in the intestines and colicky pains. After a temporary improvement she had a relapse, and returned to the hospital under the care of Dr. Harris, November 30. She was having considerable pain in the abdomen with marked tenderness over the region of the pancreas. Everything taken into the stomach was vomited. Temperature ranged from 101° to 102.4° F. Rectal nourishment was instituted and the stomach placed at rest. Improvement began at once. December 3, the blood count showed:

Reds	2,432,800
Whites	12,343

Stomach nourishment was resumed in a few days, and as the bowel movements were very offensive guaiacol carbonate was given. Improvement was progressive, and she left the hospital in good condition, December 17. December 23, a blood examination showed:

Hæmoglobin (Fleischl).....	45 per cent.
Reds	3,173,440
Whites	9060
Color index.....	0.64

Differential count of the leucocytes showed:

Polynuclear neutrophiles.....	49.4 per cent.
Small mononuclears.....	23.4 per cent.
Large mononuclears.....	12.8 per cent.
Eosinophiles	14.4 per cent.
<hr/>	
100.0 per cent.	

Attention is called to the very large percentage of eosinophiles.

Since this attack the patient has improved greatly in health and has had no further illness. During the past year she has been able to attend to her work and she has felt perfectly well, in fact, much better than she has for many years.

She has menstruated but twice since the operation, once in May, 1899, two days after the operation, and again in October, 1899, when she had the illness above mentioned. Since then there has been no sign of a menstrual flow.

When last examined, January 13, 1901, twenty months after the operation, it was noticed that the brown pigmentation of the skin, which was so marked before the operation, was rapidly disappearing. The face had a clearer and brighter color, and but a slight mottling, scarcely perceptible, remained over the abdomen. No enlarged lymph-glands were anywhere palpable. An examination of the urine showed nothing abnormal. The result of the blood examination was as follows:

Hæmoglobin.....	60 to 65 per cent.
Red blood-cells.....	3,776,000
White blood-cells.....	5200
Proportion of whites to reds.....	1 to 726
Color index.....	0.71 to 0.78

Differential count of the leucocytes:

Polynuclear neutrophiles.....	268 = 53.6 per cent.
Large mononuclear.....	106 = 21.2 per cent.
Small mononuclear.....	53 = 10.6 per cent.
Eosinophiles	57 = 11.4 per cent.
Transitional eosinophiles.....	4 = 0.8 per cent.
Basophiles	5 = 1.0 per cent.
Undefinable transitionals.....	7 = 1.4 per cent.

500 100.0 per cent.

In regard to the blood examination, Dr. Herzog, who made the count, states: "When the differential count was made on cover-glass preparations treated with triacid and with glycerin-eosin-methylene-blue stains some peculiarities were observed which deserve notice. It was frequently difficult to distinguish between the small and the large mononuclears, and the former in general seemed larger than usual. The four corpuscles appearing in the above list as 'transitional eosinophiles' were polynuclears with few and very small eosinophilic granules. The basophiles (1 per cent.) were of the type of large mononuclears or of cells of a transitional character, and they contained a moderate number of coarse granules which stained with methylene blue. As transitional were classified such cells which could neither be grouped under large mononuclears nor under polynuclear neutrophiles. It was noticed that the blood contained more indistinct, hazy shadows of degenerating leucocytes than are usually seen." A large number of microcytes were also noticed.

The points of interest in this case are:
Its long duration.

The marked brownish pigmentation which gradually disappeared after removal of the spleen.

The high temperature lasting for two weeks after the operation without known cause.

The remarkable increase in the number of blood-cells, both red and white, immediately following the operation.

The increase in the reds was succeeded by a fall, and this in time by a gradual increase in number, which was of a more permanent character.

The great reduction in the number of reds which accompanied the peculiar sick spell about six months after the operation.

The return of the reds to a fairly good number which has remained now for more than a year.

The return of the leucocytes to the normal number, but with marked changes in the relative percentage of the different varieties.

The suspension of menstruation.

CASE II.—Mr. R., widower, American, forty-seven years of age. Travelling man by occupation. The family history is good. Both father and mother lived past eighty and died of heart disease. Five sisters are all living and well.

He had typhoid fever when three or four years of age and facial erysipelas twice, at the age of six and thirty respectively. Thinks he may have had some malaria at about the age of thirty, but was never very sick with it. There is no history of syphilis or gonorrhœa, nor has he been a drinking man. About two years ago he had an attack of la grippe. With the exceptions noted, he has always been healthy and strong.

He dates his present trouble from January, 1900, when he began having pains in the abdomen in the umbilical and epigastric regions. The pains were not particularly severe, nor could any exciting cause be assigned. Later his appetite gradually failed him and he was troubled with nausea. He had but one vomiting spell shortly before he entered the hospital, but there was nothing having the appearance of blood in the vomit. Associated with his condition were a progressive loss of strength and flesh. His loss in weight amounted to from thirty to forty pounds.

When he entered the Policlinic Hospital, September 16, 1900, he was very weak and considerably emaciated. His skin was of a dull, dirty, yellowish color, almost cachectic in appearance, but there was none of the brown pigmentation noted in Case I. His appetite was not good, and he

was troubled with nausea. The bowels moved nearly every day, but often not satisfactorily. There were no urinary symptoms.

An examination revealed nothing abnormal about the lungs or heart. The liver was not enlarged. In the left side of the abdomen was a large mass extending downward from beneath the left costal arch almost to the umbilicus and nearly to the mid-line, which, from its shape, location, mobility, etc., was considered to be an enlarged spleen. There was no enlargement of any of the palpable lymph-glands throughout the body. The temperature was normal; the pulse averaged 92, and the respiration 26 per minute. Urinalysis showed:

Amount passed in twenty-four hours, 750 cubic centimetres;
 Color, quite dark;
 Reaction, acid;
 Specific gravity, 1030;
 Urea, 2 per cent.;
 Albumen, none;
 Sugar, none;
 Bile, none;
 Microscope, few oxalate of lime and urate crystals.

Blood examination:

Hæmoglobin (Fleischl).....Fifty per cent.
 Red blood-cells.....3,364,000
 White blood-cells.....28,200
 Color index.....0.74

The leucocytosis consisted in an increase in the polynuclear leucocytes. There were no myelocytes, no nucleated red blood-cells. No plasmodia were found. To sum up, we had here a case showing:

A markedly enlarged spleen without leukæmia.

There was no malaria or other pathologic condition to which the enlargement of the spleen could be attributed.

There was a moderate degree of anæmia with a diminished color index.

There was a progressive loss of strength and flesh.

Based upon these facts, a diagnosis of splenic anæmia or primary splenomegaly seemed justifiable, and removal of the enlarged organ was advised. Splenectomy therefore was performed September 28, 1900. The organ which was removed will be described in detail later.

The patient progressed slowly to recovery without incident of interest until October 21, when he had severe pain in the abdomen with distention and vomiting, and the bowels refused to move. Obstruction from adhesions was feared, and reopening of the abdomen considered. Next day, however, the bowels moved all right, and all unfavorable symptoms quickly disappeared. He had no further trouble.

For ten days after the operation his temperature ranged from 99° to 100° F., once reaching 101° on the second day. There were no local

conditions to which this temperature could be attributed, unless a slight bronchial irritation due to the ether was sufficient. There was no material change in the blood count during his stay in the hospital, although the tendency was to improvement. Thus a blood examination, October 19, 1900, showed:

Hæmoglobin (gravity test).....	62½ per cent.
Red cells.....	3,864,000
White cells.....	24,000
Index	0.80

Differential count:

Small mononuclears.....	11.7 per cent.
Large mononuclears.....	9.2 per cent.
Polynuclear neutrophiles.....	78.0 per cent.
Eosinophiles8 per cent.
Transitional forms.....	.3 per cent.

Total	100.0 per cent.
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Number counted 1000.

He left the hospital, October 25, 1900, in good condition. He lives out of the city, but has since been heard from as doing well and attending to his business.

That these cases are not identical is likely, for it seems probable there must be some differences between a case running a rapid course of a few months with a marked leucocytosis and a case protracted over several years with a marked leucopænia. Still, the cases are sufficiently characteristic to warrant their classification under that group to which the provisional term splenic anæmia or primary splenomegaly may be applied. The characteristic features of this group of cases are:

A considerable enlargement of the spleen;

An anæmia usually of moderate degree accompanied by a lowered color index;

An absence of the blood changes peculiar to leukæmia;

Loss of strength and weight; and, finally, it may be added that the condition is usually a progressive one with a tendency to a fatal termination. As a summary of the literature of the subject has been reviewed so recently by Sippy (*American*

Journal of the Medical Sciences, 1899, Vol. cxviii, pages 445-570), and the differential diagnosis so thoroughly considered by Osler (*American Journal of the Medical Sciences*, 1900, Vol. cxix, page 54), no attempt will be made to again go over this ground.

One statement, however, made by Sippy needs to be modified in view of more extensive experience. He states that the disease may terminate fatally in from five to six months, and that three and one-half years is the longest duration recorded. While the first part of this statement is probably correct, the last part must now be modified, as the disease in my first case had existed for at least nine years, and Osler reports several cases in which the condition had existed from five to twelve years.

Concerning the pathogenesis of this group of cases but little or nothing is known. It cannot even be stated with certainty in which organ or tissue the first changes make their appearance, although the evidence thus far obtained seems to point with great probability to the spleen as the part primarily at fault. The changes which take place in this organ will be described in detail later.

The changes which take place in the blood, so far as known, consist in a diminution in the number of erythrocytes with a reduction in the percentage of hæmoglobin, thus giving a lowered color index. So far as the leucocytes are concerned, there may be a leucocytosis (28,200, Case II) or a leucopænia (2600, Case I), usually the number is below normal. The differential count shows no characteristic changes.

After the removal of the spleen, however, a marked change is noted in the relative proportion of the different leucocytes, although the total number remains about normal. This change consists in a large increase in the percentage of eosinophiles. An eosinophilia has been observed in animals after removal of the spleen as well as in man ("Histology of the Blood," Ehrlich and Lazarus, 1900).

It requires some months for the eosinophilia to become marked. In Case I, seven months after the operation, the

eosinophiles formed 14.4 per cent. of the total number of the leucocytes, and twenty months after the operation, 11.4 per cent. Another change noted is an increase in the percentage of the large mononuclears. In Case I, these, at the end of seven months, had increased to 12.8 per cent., and at the end of twenty months to 21.2 per cent. The significance or explanation of these changes in the relative proportion of the leucocytes cannot at present be given.

While it is freely admitted that the cases so far recorded and the facts at present at our disposal are not sufficient to warrant any positive deductions concerning the histogenesis of splenic anæmia, it may not be amiss to consider some points in this connection.

One of the important questions to decide is: Does the anæmia precede and cause the enlargement of the spleen, or is it secondary thereto? Jawein (*Virchow's Archiv für Path. Anat.*, 1900, Vol. xvi, p. 461) has shown that a pathologic destruction of red blood-cells is always followed by an enlargement of the spleen. This was found to be true clinically as well as experimentally. By the introduction of erythrolytic substances (chlorate of potash) into the blood of animals he was able to produce an enlargement of the spleen at will, and, furthermore, there seemed to be a direct relation between the degree of enlargement and the number of red cells destroyed. He therefore concludes that the chief function of the spleen is to remove dead red blood-cells from the circulation, and that such dead cells have the specific property of stimulating this function. Thus is explained the enlargement of the spleen which takes place in certain infectious diseases, chronic malarial poisoning, etc., conditions in which an abnormal destruction of erythrocytes occurs.

At first sight, it would not seem unreasonable to apply the facts brought to light by Jawein's experiments to splenic anæmia; to suppose that, owing to some unknown cause, there was a persistent abnormal destruction of the blood-cells, which dead cells, through their specific effect on the spleen, excite an enlargement of this organ.



FIG. 1.—Section of spleen removed in Case I, showing infarct.



While this explanation appears quite simple and specious, there are facts which speak strongly against it. The most forcible of these is the fact that apparently perfect recovery follows removal of the spleen. The erythrocytes immediately begin to increase in number and the general condition of the blood improves.

It is impossible to reconcile this with the supposition that the splenic enlargement is secondary to the anæmia, that it is,

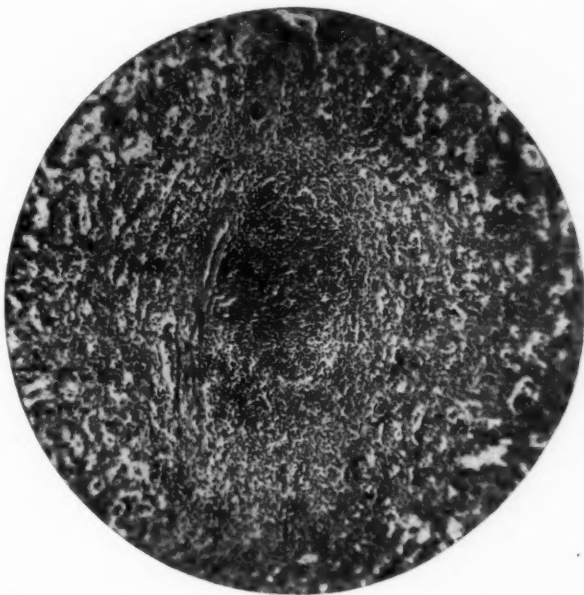


FIG. 2.—Malpighian body surrounded by enlarged blood lymph spaces of splenic pulp. Photomicrograph from Case II.

in a sense, a hypertrophy due to increased activity. It seems, therefore, much more probable that the splenic enlargement is primary, be its cause what it may, and that the anæmia is dependent thereon. This does not elucidate, however, the essential nature of the disease. Let us now consider the changes found in the spleen.

Macroscopic Description.—The spleen removed in our first case had retained its shape fairly well; it is enlarged in all of its dimensions. Its diameters are 21 by 13.5 by 7 centi-

metres. Weight, after having been hardened in 4 per cent. watery formalin solution, 1055 grammes. The surface is smooth on the whole, except in a few places where it had formed adhesions to the omentum. The organ is harder in consistency than normal. A wedge-shaped infarct extends from the hilum to the upper surface. Capsule thickened.

The spleen in our Case II is of the typical spleen shape and uniformly enlarged in all of its dimensions. Diameters: 18 by 12½ by 6 centimetres. Weight, after having been

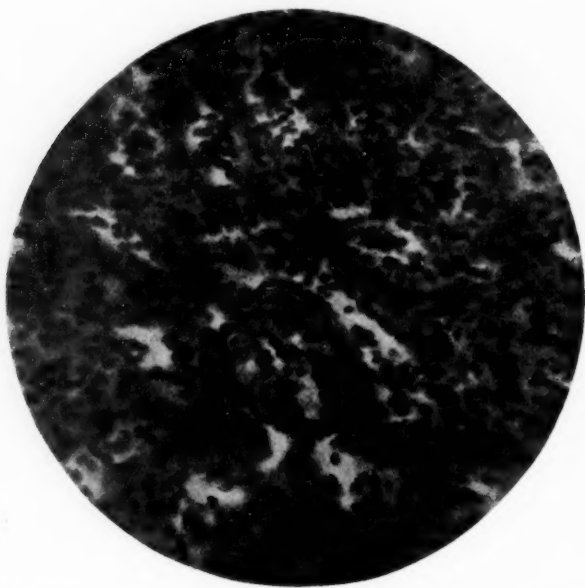


FIG. 3.—Enlarged blood lymph spaces of splenic pulp. Photomicrograph from Case II.

hardened in a 4 per cent. watery formalin solution, 600 grammes. Surface slightly uneven and wrinkled; capsule highly thickened; spleen tissue somewhat firmer than normal, however not as firm as in Case I. The surface shows a few grayish white spots.

Histopathology.—In studying the histopathology of splenomegaly, one is confronted with the difficulty that there are still a number of disputed points in the histology of the

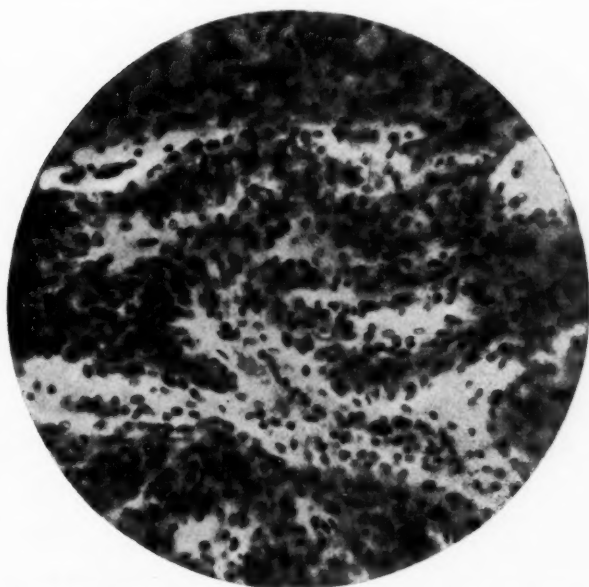


FIG. 4.—Enlarged blood lymph spaces of splenic pulp. Photomicrograph from Case II.

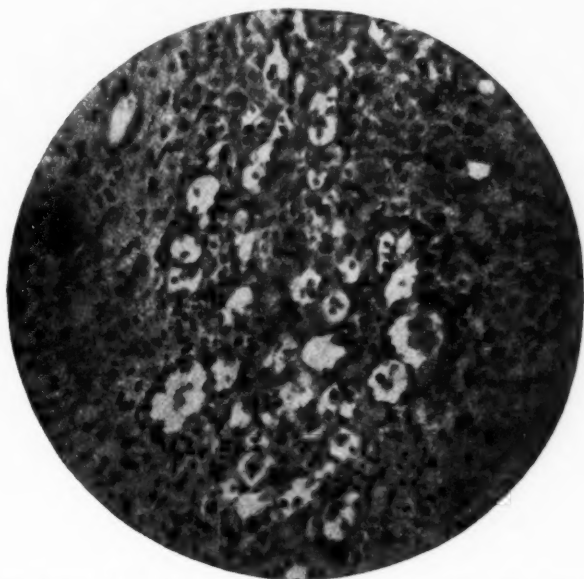


FIG. 5.—Enlarged blood lymph spaces of splenic pulp. Photomicrograph from Case I.

normal spleen, and that normal human splenic material is almost beyond one's reach.

Among the latest contributions to the normal histology of the spleen are those of Bannwarth and Kultschitzky. The papers of Hoyer have not been accessible to us, and the latest contribution of Mall has very little bearing upon our histopathologic considerations.

Bannwarth,¹ from his investigations, comes to the conclusion that there exists in the splenic pulp an open intermediary blood space with a common blood and lymph circulation. The common blood lymph spaces in the splenic pulp are, however, generally not lined by endothelial cells.

Kultschitzky² gives the following summary of his

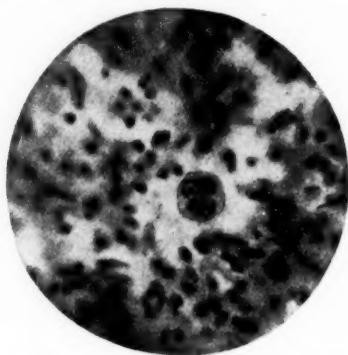


FIG. 6.—Giant cell with four nuclei. Photomicrograph from Case I.

views: "I now feel compelled (in opposition to views held formerly) to admit that there exists in the spleen an open blood circulation, as was first described by W. Müller. I am now adopting this view partly in consequence of the more recent contributions of Hoyer, G. Hoyer, Bannwarth, and Sokolow, and partly in consequence of my own personal observations. . . . We, therefore, find that older observations as well as those of the most recent date concerning the normal

¹ Untersuchungen über die Milz Archiv für Mikroskop. Anat., 1891, Vol. xxxviii, p. 345. and Neuere Milzuntersuchungen, etc. Correspondenzbl. für Schweizer Aerzte, 1893, Vol. xxiii, p. 586.

² Zur Frage über den Bau der Milz Archiv für Mikroskop. Anat., 1895, Vol. xlv, p. 673.

histology of the spleen establish the fact that there exists in its pulp open blood-spaces. These latter are formed by connective-tissue fibres and cells, and they partly show an incomplete lining with endothelial-like cells. Split arterial capillaries and small arteries pour their blood into the lymph-clefts of the pulp. The blood here mixes with the lymph and the mixture is carried away by venous capillaries and veins."

If, now, after this consideration of the normal histology of the spleen, we turn to the histopathology of splenomegaly primitive, we find only few extensive and correct contributions to the subject.

It may be stated here that the histologic changes in splenomegaly consist chiefly in a proliferation of endothelial elements as they have been described very recently in a most excellent manner by Bovaird,¹ who, however, is not the first author to observe the endothelial hyperplasia in splenic anæmia.

Gaucher described the endothelial proliferation in 1882 in a "Thèse de Paris," but he had then wrongly interpreted what he saw, and spoke of an "Hypertrophie idiopathique de la rate sans leucémie," or an "épithélioma primitif de la rate." In 1892, however, he gives a somewhat modified description, and clearly states that the proliferated cells which he mentions are of connective tissue and not of epithelial origin. He describes these cells as "cellules nucléées d'aspect épithélial," and he says that they owe their origin to a "proliferation irritative des éléments conjonctifs sous l'influence d'une cause encore inconnue."

Picou, in 1895, reported a splenectomy for splenomegaly, and he also describes the large proliferated epithelial-like cells, and mentions that some contain two to three nuclei. He states these cells are endothelial cells, and he calls the condition of the spleen an "endothélioma primitif." Cornil, speaking about Picou's case, thinks that the condition is one of primary hypertrophy of the spleen with proliferation of the elements of the pulp.

¹ Primary Splenomegaly Endothelial Hyperplasia of the Spleen, The American Journal of the Medical Sciences, October, 1900.

Collier¹ reports a case of a child six years old in whom the spleen began to enlarge at the age of two. At the post-mortem the spleen weighed four pounds two ounces. The author states that on microscopic examination the splenic reticulum is seen to be replaced by very large endothelial cells. It is stated that an older sister of the child likewise suffered from a fatal enlargement of the spleen.

Williamson² reports a case of splenomegaly with microscopic examination of the spleen. The patient was a boy nine years old, who was admitted to the Manchester Royal Infirmary on February 15, 1892. A blood examination showed red blood-corpuscles, 3,030,000; white blood-corpuscles, 4000; hæmoglobin, 22 per cent. July 14, 1892, the child died.

The histological examination was much complicated by the fact that the child died of typhoid fever. Strange to say, the author denies that death was due to typhoid, but the macroscopic and microscopic findings clearly show it. Post-mortem examination demonstrated ulceration in ileum, perforation at the site of one ulcer, general peritonitis, endocarditis of the mitral valve. Microscopically the spleen showed fibrous trabeculae much thickened, fibroid changes of Malpighian bodies, splenic pulp congested, and the sinuses contained large and small nucleated cells. The most striking feature was the presence of enormous numbers of large nucleated cells, each containing a number of red blood-corpuscles. These large phagocytic cells which are characteristic of typhoid changes were observed by Billroth as early as 1862, and they have been described fully recently by Mallory.³

Sippy in his case describes the histology of the spleen as follows: "The majority of the Malpighian corpuscles show only slight alterations. Many appear normal, others present a slight increase in the reticular tissue, and now and then a Malpighian body is found which shows considerable sclerosis.

¹ A case of enlarged spleen in a child six years old. *Transactions of the London Pathological Society*, 1895, Vol. xlvi, p. 148.

² Cases of anæmia with great enlargement of the spleen, *Manchester Medical Chronicle*, 1893, Vol. xviii, p. 103.

³ A Histologic Study of Typhoid Fever, *Journal of the Boston Society of Medical Sciences*, April, 1898, also *Journal of Experimental Medicine*.

No marked degenerative changes are to be seen in the cells. The veins show a moderate increase in the connective tissue which surrounds them, areas are found where this increase is very marked. Fibrous tissue extends some distance into the splenic pulp, enclosing within its meshes lymphoidal cells, isolated and in groups. In many places the pulp appears normal; however, in general, it is apparent that the reticulum is considerably increased. Here and there are to be found areas of marked sclerosis containing lymphoidal cells in the meshes of the fibrous issue."

We now come to the most recent publication upon the subject, namely, that of Bovaird, who reports two cases:

CASE I was that of a girl who, at the age of three years, was first seen in November, 1896. Swelling of the spleen was diagnosed, and the blood examination gave the following result: Red corpuscles, 4,400,000; leucocytes, 9000; hæmoglobin, 75 per cent. The child was again seen after three years (1899). The abdomen at the umbilicus now had a circumference of twenty-three and one-fourth inches. Examination of the blood was as follows:

Red corpuscles.....	4,180,000
Leucocytes	14,000
Hæmoglobin .....	.62 per cent.
Polynuclear .....	.57.5 per cent.
Large lymphocytes.....	.29 per cent.
Small lymphocytes.....	.12.5 per cent.
Eosinophiles .....	.1 per cent.

CASE II was an older sister of Case I. When first seen in November, 1896, she was thirteen years old. Enormous swelling of spleen was present, which first began to show itself when the child was three years old.

Blood examination:

Red corpuscles.....	2,880,000
Leucocytes	4000
Hæmoglobin .....	.60 per cent.

In 1899, or when sixteen years old, the splenic tumor was larger, and a blood examination showed:

Red corpuscles.....	3,550,000
Leucocytes	7000
Hæmoglobin	not given
Large lymphocytes.....	.15 per cent.
Small lymphocytes.....	.21 per cent.
Polynuclears .....	.62 per cent.
Eosinophiles	1.4 per cent.

Splenectomy, May 17, 1899; death three hours after the operation. Spleen after removal weighed twelve and one-half pounds. Shape in general that of a normal spleen.

Bovaird in his very extensive microscopic description states that the pulp spaces are much enlarged, lined by large endothelial cells, and often contain masses of proliferated endothelia. There are also found polynuclear giant cells. On other places there is found a fibrous connective tissue, and pictures are seen which suggest the transformation of the large endothelial cells into fibrous connective tissue. The abdominal lymph-nodes and the lymph-clefts of the liver likewise show masses of proliferated endothelial cells.

The author raises the question: Is this a diffuse endothelioma of the spleen with metastasis in the abdominal lymph-nodes and the liver? This he answers in the negative. He considers the changes in the spleen those of a diffuse endothelial hyperplasia, and believes that the same morbid influences which caused the splenic changes also produced an endothelial hyperplasia in the abdominal lymph-nodes and in the liver.

Histopathology of Our own Cases.—(The material which had been hardened in dilute watery formalin was embedded in paraffin, and the sections were studied with a variety of stains.) Case II shows the changes which have taken place much clearer than Case I, so its microscopy will be described first and more fully.

CASE II.—The capsule of the spleen is thickened and consists of a fibrous connective tissue, rather poor in nuclei. Weigert's elective stain shows a number of elastic fibres. The trabeculæ are likewise thickened and contain the same tissue elements as the capsule. The latter as well as the former contain a few involuntary muscle fibres. The Malpighian corpuscles in general show few changes. Here and there evidences of a sclerosis are manifest. This is particularly seen in the cortical portion of some Malpighian bodies where the fibrous connective tissue is markedly increased and the lymphoid elements proportionately decreased. The most marked changes are found in the splenic pulp. The simple clefts of the pulp, partly and incompletely lined with endothelia, have disappeared, and all lumina seen possess a complete endothelial lining. The condition is such that it is impossible to say with certainty what has originally belonged to the capillaries and what to the pulp lymph-clefts.

The endothelia which line the common blood lymph spaces have not the character of normal flat vascular endothelia, but are cubical cells with comparatively large vesicular nuclei fairly rich in chromatin. The medium-sized cell protoplasm is finely granular and stains well with eosin. Quite a number of karyokinetic figures are seen in the endothelial cells. In

some places the proliferation of these cells has been so lively that numbers of dropped-off endothelia are seen in the lumina. Some of the cells contain two, three, and four nuclei. The open blood lymph spaces also contain a large number of leucocytes, viz., lymphocytes, neutrophile polynuclear leucocytes, and eosinophiles. Red blood-corpuscles are not found in any numbers in the pulp spaces. This must be due to the fact that the blood was allowed to escape from the spleen after its removal. It is very probable that, as the blood ran out, almost all of the erythrocytes escaped, while the more sticky leucocytes were held back.

In spite of the fact that the open spaces are not completely filled, they are mostly found gaping and open. This is due to the fact that they have thick walls. This expression, however, is not quite correct. The wall proper of the spaces is really only formed by a single layer of endothelia, but the lumina are separated from each other by rather thick tissue septa. These show very little fibrous connective tissue, but are almost wholly made up of connective-tissue cells of an embryonal character, which, in appearance, are very similar to the endothelia described. Bovaird states that he saw in his case pictures which strongly suggest the transformation of the endothelia into connective-tissue fibres. Anything like this cannot be well seen in our case. But such a change is by no means improbable. The splenic pulp shows an abundant infiltration with hæmosiderin and hæmatoidin. Large phagocytic cells containing included erythrocytes were not seen, but some of the endothelial cells contain hæmatoidin and hæmosiderin granules.

CASE I shows histologic changes similar to Case II. They are, however, not so clearly demonstrable. The pulp spaces are collapsed in many places, and the endothelial lining is not so uniformly present. The ischæmic infarct shows the usual changes, namely, necrobiosis of the cellular elements with loss of staining properties of the nuclei. The tissues contained in the zone of the infarct still show to a large extent the original structure. The amount of fibrin found in the infarcted area is not large. The infarct thus appears of recent origin. Surrounding the infarct is a hyperæmic zone with blood extravasation and migration of leucocytic elements into the ischæmic area.

From the above description it appears obvious that the chief histologic changes found in splenomegaly consist in an endothelial proliferation, an endothelial hyperplasia. The French first looked upon the changes found in splenomegaly as an epithelioma, but later called it an "endothélioma primitif de la rate." Cornil has opposed this view, and so has Bovaird. We also wish to express our belief that the changes found in splenomegaly cannot be looked upon as a diffuse endothelioma. We are of the opinion that the process is one resembling somewhat that found in lymphangioma. In the latter condition, as

in splenomegaly, there is present a proliferation of lymphatic endothelia with enlargement and new formation of lymph spaces. The changes characteristic of lymphangioma have been described by Virchow, Klebs, Vegner, Tilger, Nasse, and others, and also by one of the authors in a short paper published some time ago.

It appears to us, from its histopathology, that splenomegaly may be looked upon as a process similar to a diffuse lymphangioma. Ischaemic infarcts either in the shape of one large infarct or as a number of small infarctions have been described a number of times in splenomegaly. These infarcts probably owe their origin to cell thrombi formed by the numerous leucocytic elements found in the enlarged lymph-blood spaces.

The next question which must engage our attention is: Can the pathologic changes in the spleen explain the progressive deterioration of the blood which is found in splenomegaly? It may be considered as established that red corpuscles are normally destroyed in the spleen. It appears at first sight not at all unlikely that red corpuscles are disintegrated in the spleen through the agency of phagocytic endothelial cells.

One is tempted to assume that an increase in the endothelial elements in the splenic pulp would be followed by an increase in the number of blood-corpuscles destroyed. Yet, tempting as this hypothesis is in explanation of the progressive blood deterioration in splenomegaly, it lacks tangible evidence. We have in vain searched our sections for phagocytic cells containing red blood-corpuscles; nor does the literature on splenomegaly contain any statement to this effect. The one case cited in which such phagocytic cells were found was complicated with typhoid fever, and therefore proves nothing.

Another explanation of the *modus operandi* of the destruction of red blood-corpuscles in splenomegaly may be offered. The dissolution of senile blood-corpuscles, or those damaged by toxic influences, may not be brought about directly by the phagocytic action of certain splenic cells, but by an erythrolytic enzyme formed in and secreted by certain splenic cells. If we assume that the endothelial cells of the splenic

pulp furnish this erythrolytic enzyme, an easy explanation is offered for the great blood destruction in splenomegaly. These endothelia are enormously increased in splenomegaly, and if they do secrete an erythrolytic enzyme the latter would be increased very much. If we remove the spleen, we remove the source of the increased amount of the erythrolytic enzyme, and the blood destruction comes to a stand-still. It is also obvious that there must be other organs—the lymph-nodes—which have a moderate erythrolytic function, which comes into play more prominently after splenectomy. It appears, however, that the lymph-nodes cannot completely substitute the erythrolytic function of the spleen. It was noticed in our Case I that twenty months after splenectomy the blood contained quite a number of indistinct, hazy blood-corpuscles, and many microcytes.

One thing appears certain, namely, that the changes in the spleen must in some way be responsible for the blood deterioration in splenomegaly, otherwise removal of the changed spleen would not be such an excellent therapeutic measure as it appears to be.

Treatment.—The treatment of splenic anæmia from a medical stand-point has not proved successful. Attention is therefore particularly directed to the value of splenectomy in this class of cases.

Sippy gives an incomplete list of cases of primitive splenomegaly in which a splenectomy was performed. He cites the following cases:

CASE I.—Operator, Spencer Wells; date, 1865; female, aged thirty-four years; weight of spleen, 2672 grammes. Result: death.

CASE II.—Operator, Péan; date, 1876; female, aged twenty-four years; weight of spleen, 1125 grammes. Result: In one month patient had recovered perfectly; subsequently died of toxic enteritis.

CASE III.—Operator, Czerny; date, 1878; female, aged thirty years; weight of spleen not given; size, 23 by 12 by 8 centimetres. Result: Complete cure.

CASE IV.—Operator, Franzolini; date, 1881; female, aged twenty-two years; weight of spleen, 1526 grammes. Result: Complete cure.

CASE V.—Operator, Frascani; female, aged sixteen years; weight of spleen, 1310 grammes. Result: Death from hæmorrhage in four hours.

CASE VI.—Operator, Ceci; date, 1893; female, aged thirteen years; weight of spleen, 1300 grammes. Result: Recovery.

CASE VII.—Operator, Lindfors; date, 1892; female, aged twenty years; size of spleen, 25 by 15 by 7 centimetres. Result: Recovery.

To this list the following cases have to be added:

Banti (Splenomegalie mit Lebercirrh. Ziegler's *Beiträge*, 1898, Vol. xxiv, p. 21) reports three cases of splenomegaly with cirrhosis of the liver, operated upon by F. Colzi.

CASE VIII.—Operator, Colzi; woman. Result: Died several days after the operation from a septic puerperal complication.

CASE IX.—Operator, Colzi; young man. Result: In best of health thirty-three months after the operation.

CASE X.—Operator, Colzi; woman. Result: Was in good health twenty-one months after the operation. No anæmia.

CASE XI.—Operator, Power (Successful removal of an enlarged and displaced spleen. *British Medical Journal*, 1900, November 17, p. 1428); widow, forty-three years old; operated September 6, 1899. Three and a half years ago she struck her left side just over the lower ribs. Two years later she noticed the lower part of her abdomen increasing in size. At the operation the spleen was found suspended from a pedicle four inches long, consisting of fatty connective tissue with large veins and splenic artery. After removal the estimated weight of the spleen was two and one-half pounds. It weighed seventeen to eighteen ounces after having been in alcohol for six months. The blood examination eight days after the operation showed:

Red corpuscles.....	4,230,000
White corpuscles.....	17,000
Lymphocytes	18.75 per cent.
Large mononuclear.....	12.5 per cent.
Polynuclear	65.5 per cent.
Eosinophiles	3.5 per cent.
No myelocytes.	

The patient recovered.

CASE XII.—Operator, Cushing (Splenectomy for primary splenic anæmia. *Maryland Medical Journal*, Baltimore, 1899, Vol. xli, p. 140). The short report states that a splenectomy was made for splenic anæmia. Patient made a good recovery and gained thirty pounds in weight.

CASE XIII.—Osler. Man, aged thirty-three years. Trouble of ten years' duration:

Red blood-corpuscles	3,000,000
Leucocytes	2800
Hæmoglobin	25 per cent.
Differential count:	
Polymorphonuclears	84.4 per cent.
Small mononuclears.....	4.4 per cent.
Large mononuclears.....	5 per cent.
Transitionals	3.4 per cent.
Eosinophiles	2.8 per cent.

Splenectomy; patient recovered; continued well one year after operation.

CASE XIV is one of Bovaird's cases, which has been referred to more fully above. Girl, sixteen years old. Patient died three hours after the operation.

CASE XV.—Picou (Epithélioma primitif de la rate de Gaucher. *Bull. de la Soc. Anat. de Paris*, 5^e Ser., 1895, Vol. ix, p. 531) reports a successful splenectomy in a woman thirty-two years old. The spleen weighed 2800 grammes and was $26\frac{1}{2}$ by 14.2 by 9 centimetres.

CASE XVI.—Gaucher (De l'hypertrophie idiopathique de la rate sans leucémie *La France Médicale*, 1892, Vol. xxxix, p. 529) mentions that among three specimens of splenomegaly which he examined, there was one in which the spleen had been removed by an operation. No further details are given about this splenectomy.

CASE XVII.—M. Tscherniachowski (Hildebrand's *Jahresbericht für Chic.*, 1899, S. 720), a twenty-five-year-old woman. Duration of tumor five years. Diagnosed as essential hypertrophy of spleen. Splenectomy was performed on account of constant increase in the size of the spleen, with loss of strength in spite of treatment. Complete recovery.

To this list of splenectomies for primitive splenomegaly we can add the two cases above recorded. This then makes a list of nineteen cases, with fourteen recoveries, four deaths, and one case where the result is not stated. A mortality of a little over 20 per cent. This is certainly a very favorable showing for splenectomy.

There may be some question as to the propriety of including Banti's three cases in this list, but, as two of them recovered and were reported well thirty-three and twenty-one months respectively after the operation, it would seem that the splenomegaly was the primary and chief condition and the cirrhosis of the liver secondary thereto, and that they are therefore justly entitled to be included.

Concerning the after history of the cases that recovered, unfortunately, but little is said. In eight cases it is simply stated the patients recovered and were well, but the length of time after the operation at which the observations were made was not stated. In one case the time is specified as one year after the operation; in one case twenty-one months, and in another thirty-three months. It is to help fill in this gap that the subsequent history of our Case I was entered into in such detail, as it has now been under observation about twenty-two months.

If it can be shown, as now seems probable, that these cases do recover after splenectomy, not simply recover from the operation but regain fully their health and well being, it will establish splenectomy as the proper line of treatment in these cases, as, up to this time, medicinal treatment is acknowledged to be unsuccessful. As the difficulties as well as the dangers of the operation increase in proportion to the size of the spleen, it is advisable to operate as soon as a correct diagnosis can be established and the futility of medicinal treatment is made evident.

Concerning the technique of the operation there is but little to add. The median incision is the one most desirable in the majority of cases. Most of the operators who have removed enlarged spleens recommend dividing the gastrosplenic omentum between ligatures first, and freeing the upper end of the organ from the vault of the diaphragm in order to turn it out of the abdomen before ligating the pedicle proper. The difficulties in reaching the gastrosplenic omentum with an enlarged spleen in place are often very great, as most writers have stated; therefore, after attempting to follow this method in our first case, it was abandoned.

The incision was extended downward so that the lower end of the spleen could be drawn upward. The splenic vessels were then easily approached and ligated. The veins in these cases are enormously dilated, and so thin that they are easily punctured or lacerated in attempting to pass the ligature needle.

It is probably better to ligate at once than to place a large clamp on the vessels with the intention of ligating after the organ is removed, as the thin veins are apt to tear at the edge of the clamp during the subsequent manipulations, and great difficulty may be experienced in again getting control of the hæmorrhage. This was experienced in the second case.

After ligating and dividing the pedicle, the spleen may be drawn downward and the gastrosplenic omentum more easily gotten at.

THE BEST INCISION IN OPERATIONS FOR MAMMARY CARCINOMA.¹

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THE increasing frequency of carcinoma of the breast, the demonstrated hopelessness of partial and incomplete operations for its relief, together with the more than reasonable hope of cure following a timely and rightly done operation, warrant me in asking the attention of the Academy to a paper briefly considering the relative merits of well-known operative procedures.

Before doing so, however, we should recall the anatomy of the gland, pathology of the disease, and its natural tendency to disseminate by means of the lymphatics. The lymphatic vessels are far more numerous and complicated than Sappey and former anatomists had led us to suppose; for, instead of all such vessels converging to the nipple and thence passing by main channels beneath the skin to the axillary nodes, we now appreciate, from the teachings of Mascagni, Langhans, Küster, Stiles, and Heidenhain, based upon injections, that there are several other important, if not as much frequented, channels. There are two superficial sets of lymph-vessels; in addition to the axillary set, so dwelt upon by Sappey, a second one drains the sternal half of the gland passing through the second and fourth intercostal spaces, to discharge their contents into the lymphatic glands of the anterior mediastinum.

There are also three deep sets of lymphatic vessels. One, beginning in the mucous membrane of the milk-ducts and

¹ Read before the Philadelphia Academy of Surgery, February 4, 1901.

acini, drains the deeper portions of the axillary half of the gland, joining the superficial set in the axilla, and forming with it a network which surrounds the axillary vein, almost or quite up to the clavicle.

A second set drains the deeper portions of the sternal half of the gland, perforates the second and fourth intercostal spaces, following the course of the internal mammary artery, to finally empty, together with the superficial set, into the mediastinal glands. On the right side they intermingle with the lymphatics of the liver. Hence it is easy to explain the frequent and early implication of the mediastinal glands, which cause bulging of the bone or "sternal symptom" of Snow, in cancers originating in the sternal half of the gland.

A third deep set drains the middle of the base of the gland and retromammary tissues, then perforating the intercostal muscles and spaces to follow the course of the intercostal arteries to the spine; thereby affording a ready explanation of those cases ultimately complicated with spinal symptoms, even paraplegia.

It will therefore be at once appreciated how necessary it is to have in mind more than one avenue of possible infection.

This arrangement of the superficial and deep lymphatics also offers a ready explanation of the clinical fact, that carcinomata affecting the inner half or sternal quadrants of the gland are more quickly fatal than those occupying the outer half or axillary quadrants. I have rarely seen cancer of the inner half of the gland that was not quickly fatal, and have gotten to look upon the location of the growth and the age of the patient as the two most reliable *early* prognostic signs. While carcinoma is comparatively infrequent under thirty, when it does occur it is almost certain to run an unusually rapid course. I have operated upon only three cases of mammary cancer in women under thirty, aged twenty-five, twenty-seven, and twenty-eight respectively. One died within six months after operation in spite of a seemingly complete Halsted procedure. Another died eleven months after operation,

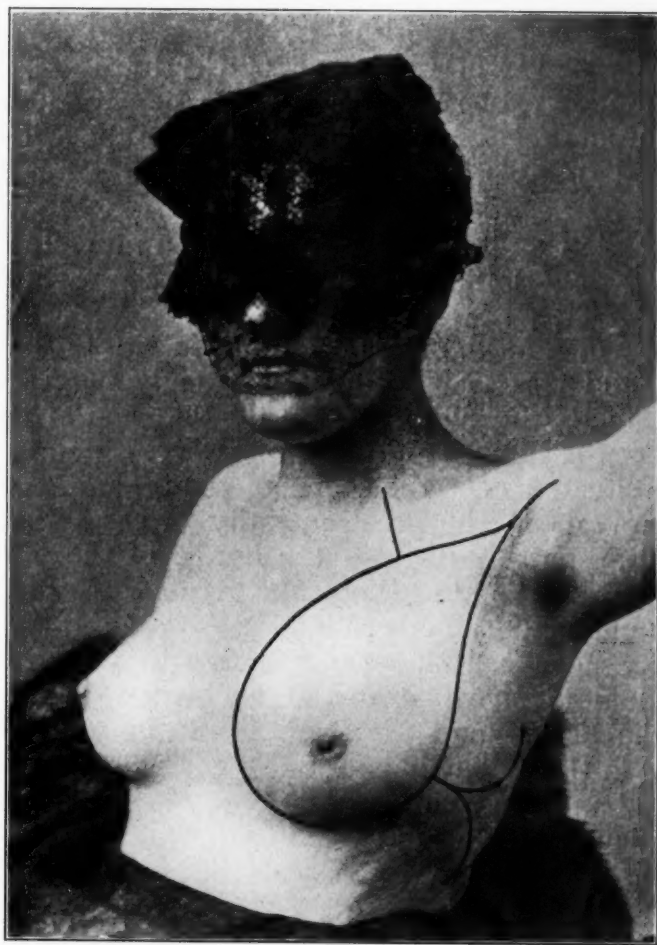


FIG. 1.—Warren's incisions in removal of breast for cancer—
"International Text-Book of Surgery."

notwithstanding the fact that everything but her age indicated that a radical cure would be effected. The tumor was small, perfectly movable, and there was not extensive axillary infection; in truth, no enlargement of the glands could be made out before the axilla was opened. The case was such a border-line one, so far as diagnosis was concerned, that a pathologist was asked to be present at the operation, so that the tumor could be examined immediately and reported upon. It is not my practice to sacrifice the entire gland in young women with tumors demonstrably benign; and in cases of doubtful diagnosis, from a clinical stand-point, a competent pathologist is asked to be present and ready to make frozen sections and then give a reliable report, which can usually be done in less than fifteen minutes. I have taken this precaution for many years, and have been kept from making mistakes in at least two instances. An incision into the tumor with macroscopic examination is insufficient, and, now that we have a better plan, should not be relied upon. In a few minutes Professor McFarland reported back "cancer, undoubtedly." The entire gland with its covering of skin, and the fascia and superficial fibres of the pectoralis major, were removed, along with all axillary glands and fat. In September, 1898, ten months after the operation, she returned to Philadelphia to consult me, and I was amazed to find extensive carcinosis of the skin of the chest, and marked evidences of metastases in the lungs. She died about a month later. The third case is at present under my care, and, from the progress of the disease up to date, will probably end as the other two have done.

The cases referred to came close together in my experience,—one having been operated in December, 1897; another, in May, 1898, and the third in November, 1899. Until these cases were encountered, I had never seen carcinoma of the breast prior to thirty, and therefore could not appreciate, so fully as I now do, that the malignity of the disease is directly proportional to the *youth* of the patient. Per contra, in the very old it frequently runs a relatively benign course.

Not only is the entire gland to be sacrificed in every case, but all outlying supernumerary glandular elements should be removed at the same time. Moreover, the *manner* in which the gland is detached is of importance, as it should be done from *above* downward instead of from *below* upward, the plan followed by a majority of operators. It is quite inconsistent to remove the gland from below upward and clear the axilla from above downward; yet this is usually advised by authors, and carried out by operators, on account of the supposed advantage of not having blood obscure the field as the lower part of the incision is made. The advantage of such a course is so slight, if it exists at all, that it is as nothing against the weighty reasons, anatomic and surgical, for the opposite one. The breast should be detached near the sternum first, and the dissection made towards the axilla, where a narrow tail of tissue will be cut last. The incision must include all the skin covering the tumor, and should embrace that over the entire gland. I will state it as my conviction that more recurrences are due to leaving infected skin behind than to any other one cause, and that a probability of such mistakes having been made will be furnished by a study of recurring cases. It has certainly been the case in my own practice, and I candidly admit it. I have also frequently seen other surgeons do a very complete operation so far as the axillary dissection and other steps were concerned, and yet have felt at the time that an abiding result was made next to impossible on account of the primary incision, which included between its lips only a small, elliptical piece of skin.

The mistake is always presumably due to the natural and very proper desire to secure immediate union on the one hand, and to avoid undue scarring of the patient on the other. There is, I believe, a prejudice against skin-grafting as a supplemental step in this operation which is shared by operator and patient; the first, because it prolongs the operation and not infrequently fails to accomplish its intended purpose; the second, because it leaves unsightly scars. My private patients have usually objected to it. Women are very prone at best to delay seeking



FIG. 2.—Showing Case I as it appeared before second operation.



surgical aid for a mammary growth on account of the mutilation and asymmetry following excision. This very common operation—and I believe now becoming a life-saving as well as palliative procedure—should be stripped of every avoidable objection, so that women will be encouraged to such and submit to earlier operation: therein lies our only chance for real advance, as operative measures for breast cancer have been seemingly carried to the very Ultima Thule of surgical limits.

Remembering always the tendency to early contamination of the axillary glands, the primary incision must in every case be carried into the axilla, and this space, from base to apex, be thoroughly cleared of glands and fat, leaving, when the work is completed, vessels and nerves to stand out as plainly as in a dead-room dissection. The space of Mohrenheim, as well as the interval between the two pectoral muscles, must have careful attention in operations not contemplating their removal. It is very important to remove breast, lymphatic glands, and intervening lymph vessels in one mass, thereby avoiding cutting across lymph-bearing channels and liberating cancer cells to probably infect neighboring tissues and cause regional recurrences.

The researches of Heidenhain and Volkmann demonstrated that the fascia covering the great pectoral muscle, along with its most superficial fibres, should be removed in every case of carcinoma.

The fascia unquestionably acts as a barrier to the proliferations of the disease for a time, and in cases operated early, it is superfluous to remove the muscle. It has usually been my practice to remove both pectoral muscles only in cases of the third degree; that is to say, where the gland was adherent to the muscle beneath and immobile. There is a growing tendency with me, however, to remove the muscles in *every* case, even though not visibly infected. I do it more because a free axillary dissection can be made with greater primary and secondary safety to the patient. One may reasonably question whether or not it is possible to clear the

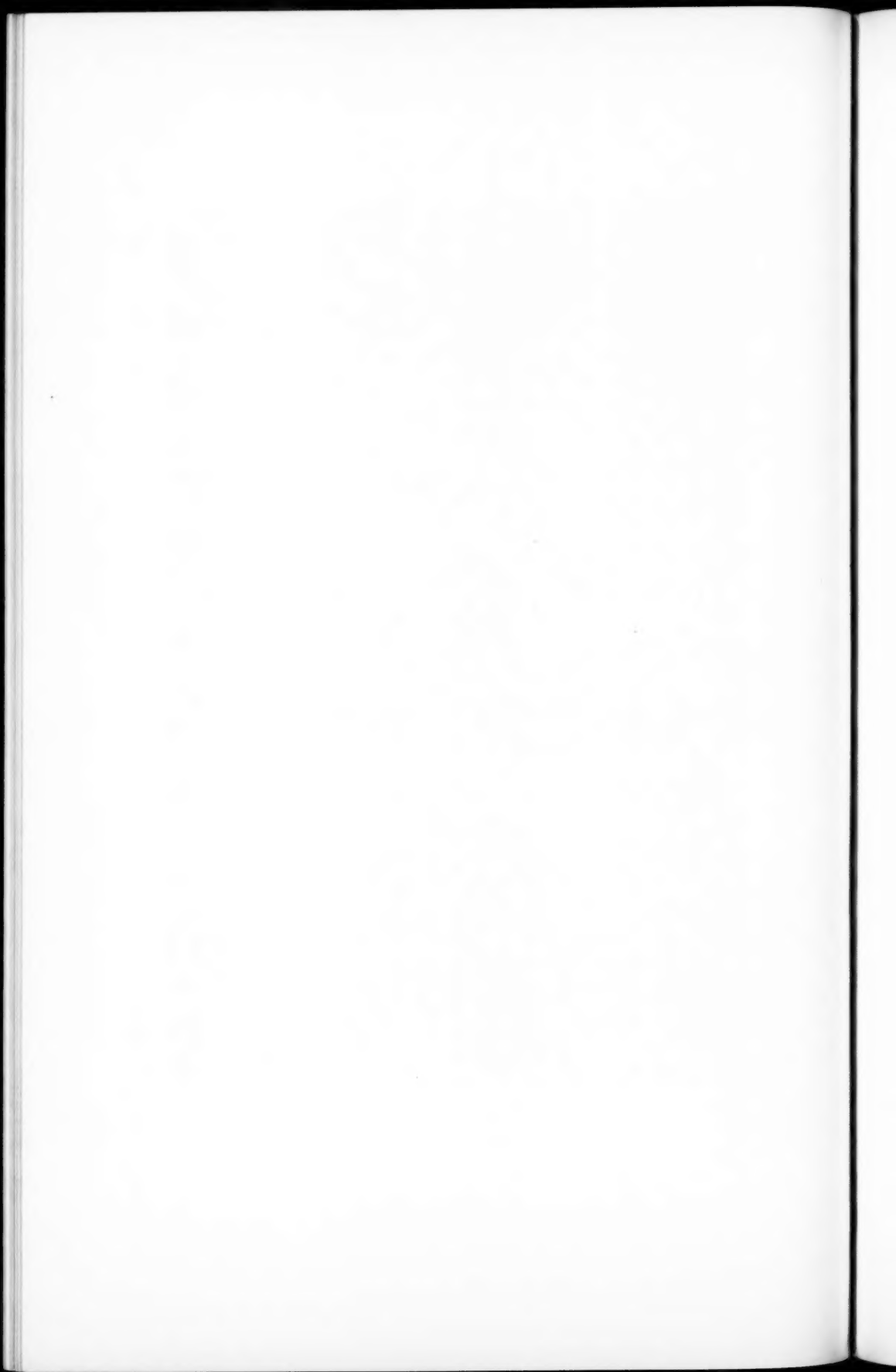
axilla of all glands and fat with the pectorals *in situ*, and the danger of hæmorrhage is probably too great for it to be attempted. Many of us have thought that we accomplished more than was done, and a comparison between two cases, operated by Halsted's and Kocher's methods, respectively, will undeceive any one. The latter operator and surgical genius practised and advised the removal of the pectoral muscles—major and minor,—if it seemed to be necessary, before the publication of Halsted's method. He did it exceptionally and not usually, however. In the Kocher operation, retractors are used to hold the muscles out of the way and assist in uncovering the axillary vessels and nerves.

There are, as we know, several excellent methods of removing the mammary gland, and each has its champions. The best of them are more or less imitations of Halsted's method,—the first complete operation as we now understand the term. The principles he taught were at once recognized and accepted in the main by surgeons everywhere. Many may, and do honestly, differ with him as to the necessity of this and that detail in his technic; but all agree that nothing short of a large wound and a thorough axillary dissection avails aught.

What are the essential features of the best incision in breast operations? I would answer by saying, in the first place, that it should be large enough to include all infected skin. Second, expose the pectoral muscles from origin to insertion. Third, it should uncover the axillary blood-vessels and nerves. Fourth, it should have regard for the future usefulness of the arm. Fifth, it should, if possible, admit of primary union without the necessity for skin-grafting. Sixth, the operation should be completed within a reasonable time. We may say in all fairness that most of the above conditions may be fulfilled equally by Halsted's, Kocher's, Shrady's, Senn's, Warren's, and some other methods; but I am impressed with the belief that we owe to Professor Warren a most valuable step in advance, inasmuch as we can by his method secure primary union even after the removal of the largest tumors,



FIG. 3.—Before second operation in Case II.



without the aid of skin-grafting. Of course primary union is desirable, and should be had with, if it cannot be had without, skin-grafting. Still, it is certainly better, in my judgment, to be able to bring the lips of the wound together if it can be done without too much tension, rather than close the gap by skin-grafting. Warren's device is simple, and in the three cases in which I have tried it, it was certainly satisfactory. I was able to close the largest wound I have ever made, or seen in my life, by this method slightly modified. The modification referred to consisted in making the curved incision, or what may be called the inverted Y, above as well as below the wound and undermining the flaps after the method first advised by Shrady, with the additional use of deep, relaxation sutures, which are shown in the photograph taken after the wound was closed. In each of the three cases where it was used primary union has occurred. None of them were in the hospital as long as a fortnight,—one leaving on the eleventh, one on the twelfth, and one on the thirteenth day after operation.

Another advantage that it undoubtedly has over Halsted's operation is that it takes less time, for at least thirty minutes will be occupied in cutting and placing grafts, should they be necessary. This, I submit, is an important element, more so than the sentimental one already referred to; especially is it so in elderly patients who have already been under the influence of ether from one to three hours.

The future usefulness of the arm will be as much interfered with by one operation as another. It is really surprising that none of these extensive operations are followed with as much interference with the arm as one would think. In all of my cases of Halsted's, Kocher's, and Warren's operations, the arm on the affected side has been fairly useful. Women are able to feed themselves, adjust their clothing, and even comb their back hair, which is a crucial test, and most difficult to accomplish where there is much restriction in the latitude of motion.

Within a week I have received a letter from Dr. D. H.

Keller, of Bangor, Pa., in reference to a case of his upon whom I did an extensive operation in October last for a recurring carcinoma of the left breast. In it he says, "Mrs. M. doing very nicely; can use her arm at all times; combs her hair, and does a great deal of the house work. Her health excellent; sometimes a shooting pain in her right mammary gland, but no enlargement whatever." The pain in the right breast must be neuralgia, as she has complained of it for more than a year. She called my attention to it more than once. Both muscles were removed in this case from origin to insertion, and a large amount of skin was sacrificed on account of a condition shown by the photograph here exhibited. A very large wound was made after the method of Warren,—larger than any I have ever made save the case already described; yet it united *per primam* in a woman not very robust, and past sixty-five years of age. She went to her home on the twelfth day after operation, and could have gone sooner.



FIG. 4.—After operation.

The first part of the book is devoted to a general
 introduction to the subject of the history of the
 world, and to a description of the various
 countries and peoples which have been known
 to man. The second part is devoted to a
 description of the various religions and
 philosophies which have been known to man.
 The third part is devoted to a description of
 the various governments and laws which have
 been known to man. The fourth part is
 devoted to a description of the various
 sciences and arts which have been known to
 man. The fifth part is devoted to a
 description of the various customs and
 manners which have been known to man.
 The sixth part is devoted to a description
 of the various languages and literatures which
 have been known to man. The seventh part
 is devoted to a description of the various
 inventions and discoveries which have been
 known to man. The eighth part is devoted
 to a description of the various wars and
 battles which have been known to man. The
 ninth part is devoted to a description of the
 various revolutions and changes which have
 been known to man. The tenth part is
 devoted to a description of the various
 events and occurrences which have been
 known to man.

ANEURISM OF THE THORACIC AORTA OF TRAUMATIC ORIGIN; TREATMENT BY INTRODUCTION OF WIRE AND ELECTRICITY.¹

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J. S., aged twenty-three years; male; was injured in November, 1899, by a heavy box, weighing 500 or 600 pounds, which fell two feet, striking him upon the chest. He was unable to work for six weeks, but at the end of that time resumed his labor, complaining, however, of a tightness and pain in his chest, which he considered a heavy cold. He was able to work at intervals, though with difficulty, for more than six months, when the pain and pulsation of his chest, steadily increasing, disabled him. He was told at that time that his heart was injured, and he was put to bed. His cough soon became troublesome, and the pain in the chest was severe, especially at night. There was occasional expectoration of bloody mucus. Worked a little through the autumn. Admitted to the Presbyterian Hospital, Medical Ward, in charge of Drs. Musser and Sailer, December 9, 1900, being thirteen months after the injury to his chest. Married; one child; *no history of syphilis*; no palpable or visible change in arteries; only slight pulsation visible in neck; no tracheal tugging; no suprasternal pulsation along carotids, subclavians, or innominate.

Right Thorax Anterior.—Powerful distinct systolic uplifting over whole right thorax at each pulsation, most noticeable in thin area at junction of third and fourth ribs with their cartilages. Slight thrill. Right axillary vein distended. Respiratory sounds practically absent over right lung. Dulness on percussion over whole chest. Systolic blowing heard from first interspace, downward throughout entire chest, and outward to axilla.

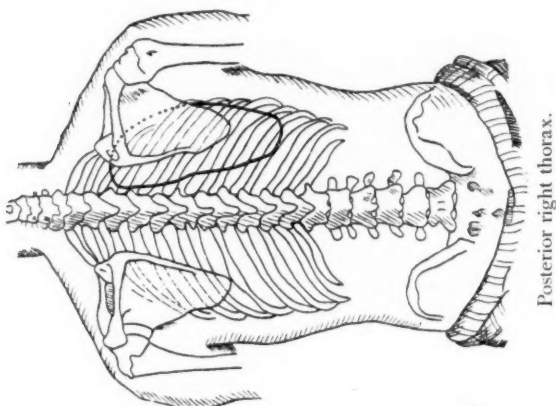
Left Side Anterior.—Violent heaving pulsation of heart's apex diffused for three inches below the normal position. Loud systolic murmur and loud first sound over entire upper left thorax.

Posterior Right Thorax.—Decided pulsation visible and palpable over entire right chest. Long, loud systolic murmur over entire area, especially loud at base. Resonance of lung only feebly heard. Has bloody expectoration; cough; dyspnea.

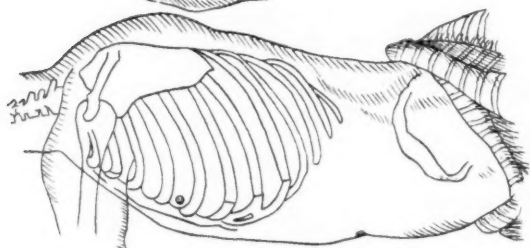
¹ Read before the Philadelphia Academy of Surgery, February 4, 1901.

Skiagraph taken, but not satisfactory.

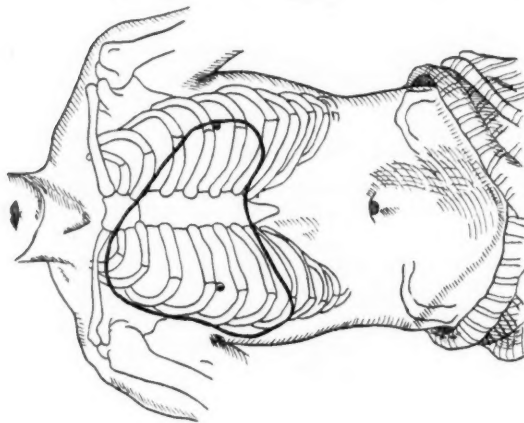
Patient was put at rest, with large doses of iodide of potassium and restricted diet, for five weeks. Ice-bags for pain. Dyspnoea, pain, cough,



Posterior right thorax.



Left side anterior.



Right thorax anterior.

and bloody expectoration grew steadily worse, and the anterior wall became perceptibly thinner. Pain increased, depriving patient of sleep, even under large doses of morphia.

The position of the tumor, the absence of pulsation in the neck, and the character of the chest sounds enumerated above, indicated a traumatic lesion of the descending thoracic aorta rather than of the arch or of ascending portion, unless the dilatation was at the very origin of the vessel. As the conditions were growing worse, and rupture certainly approaching, the patient consented to accept the risks of the only operation that offered any chance of success, the introduction into the sac of a certain quantity of wire as a framework or skeleton, each coil of which might form a nucleus for coagulation, producing eddies in the sac and final consolidation. (Moore, 1864.) To facilitate coagulation upon and around this wire framework, the coagulating power of galvanism was brought to bear. (Corradi.)

Ligation was of course out of the question; in the ten cases in which the aorta has been ligated, the result has been uniformly fatal.¹ Scarification of the interior of so large a sac was not hopeful, and the simple introduction of horsehair or catgut certainly did not offer as reasonable chance of success as did the more complete method advocated by Corradi, D. D. Stewart, and others. Simple galvanopuncture urged by Cini-cellì, since it leaves behind no framework for deposit of clot, was obviously less certain in its permanent results. The injection of about 300 cubic centimetres of a 1 or 2 per cent. solution of gelatin was considered, but rejected on account of the large size of the sac.²

In this operation of wiring, it is essential that strict asepsis be secured, and that no elements of suppuration be introduced, since sepsis and faulty technique are the most frequent causes of death.

In order to protect the skin and subcutaneous tissues external to the wall of the sac from the destructive effects of the electrical current, a vulcanite cannula (size No. 7, French catheter scale) was constructed with a steel trocar (size No. 4, French catheter scale). The thickness of the vulcanite made the introduction difficult, requiring a slight nick of the skin with a scalpel. (A veterinary hypodermic needle, three inches long, and of calibre of 24, is better. It can be insulated by several coats of shellac varnish, best French lacquer set by heat, or by a porcelain coating.) The trocar was introduced in the fourth interspace, the thinnest point of the sac, just outside the costal cartilage, and was driven well into the sac. Upon the removal of the trocar a current of blood spouted three feet into the air at each pulsation of the heart, which, owing to the size of the cannula, made the loss of blood quite serious. It was, however, controlled by the finger until the wire was threaded in. Gold wire No. 35 had been procured, but proved entirely too fine, as it would not thread through the cannula without crinkling, and I was obliged to resort to silver wire No. 24. During the operation I fortunately had the benefit of the assistance of Dr. Guy Hinsdale, who furnished the following notes: "After six or eight feet had been inserted, the wire was connected with the copper conducting cord of the positive pole of a galvanic battery. The current was supplied by the electric lighting plant of the hospital, reduced by a current controller. A chloride of silver dry cell battery does well. The negative pole was attached to a large,

flat, electrode sponge-covered pad, placed between the scapulæ. Five milliamperes were turned on at first, and the force of the current was increased by fives, the patient perceiving plainly each addition, and complaining of pain chiefly in his back, especially when new pieces of wire were connected. More wire was threaded in through the cannula until about twenty feet of coils were inserted. The strength of the current was increased until, during the last fifteen minutes of the hour, eighty milliamperes were measured; eighty-five only for a moment." In my judgment, the current used was too strong, and if equally good coagulation will take place under one of moderate strength, the danger of burning the walls of the sac is lessened. Finney obtained his results with only ten to twenty milliamperes. Coagulation of the blood in the cannula took place very soon after the current was applied, preventing further hæmorrhage, and, on withdrawal of the cannula, the wires having been pushed in as far as possible, there was no hæmorrhage. The opening was closed with gauze and aristolated collodion, and the patient confined rigidly to bed. Aside from the first shock at the sight of the spouting blood, the patient suffered no serious inconvenience, save for the pain in the back, at the negative electrode, and talked cheerfully throughout the operation. He slept the greater part of the night, the next day was much better, and in five or six days was anxious to sit up, although he was not permitted to do so. The only burns were at two areas, of the size of peas, upon the back. The cathodal negative pad should have been of larger size. In a week he could with difficulty be restrained in bed; was eating and sleeping well; had no pain; was able to stop the use of morphia, and had much less oppression. The pulsation in the thorax was lessened at the end of the operation; was still less on the following day, and in a week was diminished at least 25 per cent. His statement is that he is "twice as good as before operation." The original point of thinning anteriorly is much more solid, but laterally below the axilla the pulsation is slightly increasing, and will probably require a repetition of the operation.

In the third week a dilatation of the sac outward into the axilla gave torturing pains in right arm for two days, but this pain was speedily relieved, although the pulsation in axillary region has increased, and I propose to repeat the operation. His sac may be multilocular, or the coagulum in one district may have altered the direction of the blood current, causing dilatation of a new area. Nine weeks after the operation the man was so well that he could not be restrained, and he left the hospital in spite of my earnest protest. Good consolidation of the anterior portion of the sac at the seat of operation was positive.

Abstract from notes by Drs. Musser and Sailer, on admission: "Temporal artery not visible; neck full, only slight arterial pulsation; resonance in both supraclavicular fossæ; percussion resonance on right side beginning at eleventh dorsal spine, crossing to tenth rib at posterior axillary line; no distinct respiratory movements; vocal resonance and tactile fremitus greatly exaggerated, with bronchovesicular breathing over the compressed lung which lay posteriorly near the spine; outside and

anterior to this area respiratory sounds very faint, or lost. Anterior thorax very prominent on the right side over level of fifth rib and over sternum to anterior axillary line. Vocal resonance entirely lost anteriorly; upper thorax anterior, first sound soft and blowing, second sound faintly heard. Left side anterior, apex beat at fifth space from nipple to anterior axillary line exceedingly powerful. Auscultation at apex, loud systolic murmur with first sound; faint diastolic shock and prolonged diastolic murmur. Fourth interspace, fainter systolic murmur, louder second sound, with prolonged diastolic murmur; third interspace, short fainter systolic, long soft diastolic sound; second interspace, dull rough systolic, faint and prolonged diastolic murmur. Aortic, faint first sound; loud, clear second prolonged diastolic murmur. Left lung, respiration normal at apex; vocal resonance slightly increased. Tympanitic resonance from fifth interspace to axillary. With this saccular aneurism of the ascending portion of the arch there is evidently an aortic insufficiency, with hypertrophy and dilatation of the left ventricle."

REMARKS.

Technique.—The size of the wire should be thoroughly graduated to the calibre of the needle, which latter should be tested to ascertain the smoothness of its bore, as it is essential that the wire should slip easily through it. I see no practical difference between silver, gold, and platinum wire. Size 27 to 30 is probably about the best diameter. Finney uses silver alloyed with copper, 75 copper to 1000. This, when drawn down from No. 8 to No. 27, makes a close coil, is very pliable, and corrodes moderately with galvanism. Stewart,³ who has given careful attention to this subject, found that iron wire was undesirable, for the reason that the passage of the current rapidly decomposed it and liberated iron chloride and oxide in such quantities as to be dangerous if washed into the vessels, with a probability of causing thrombi. Steel wire coils better than silver, but is too stiff, and may injure sac.

The amount of wire should be regulated by the size of the aneurism, its object being to form a skeleton for a clot; the amount should be so regulated that it will fully reach all portions of the sac, for which reason it should be previously wound so as to coil and snarl in different directions. The wire for a large aneurism can be wound upon a sterilized rolled towel, so as to make large spirals in the sac; for a smaller

sac, it should be wound upon a glass or spool; in either case it should be carefully arranged and prepared so that there will be no delay or kinking during the process of feeding the wire in through the cannula. If the wire kinks, other needles may be inserted at different points of the aneurism, all the wires being attached to the positive current. The arrangement of the coils can be well observed by feeding the wire into a glass flask. If the wire is properly wound before operation, it is very improbable that the initial point will strike the opposite wall. If too large a quantity is used, pressure upon the sac from within might cause ulceration and rupture, and might also interfere with contraction of the sac; moreover, if coils lie against the wall and the current is too strong, the sac may be burned. Moore used as high as 108 feet, and Abbe, 150; Roosevelt introduced 225 feet of steel piano wire, applying a galvanic current of twenty-five milliamperes for thirty minutes. Probably five to twenty feet would be the proper amount.

It is very important that the tissues be protected from the galvanism, lest an open sloughing track be made into the aneurism. For insulation of the needle, glass, sealing-wax, caoutchouc, etc., have been tried, but best French lacquer or varnish, set by heat, seems best. Lacquer will not stand boiling nor soaking in a carbolic solution, but it can be thoroughly sterilized by dry heat carried up to 300 degrees; then wrapped in a sterile towel. A long veterinary hypodermic is better than a trocar and a cannula, even of same size, since the wire can be inserted half-way into the needle before the puncture is made, and assists in controlling primary hæmorrhage when the needle is inserted.

There is always risk that the wire may enter the aorta, as has happened in several cases, and minute or larger clots may be washed off and form emboli.

Traumatism as a cause of aortic aneurism is not largely mentioned by authors, although cases are reported by Lancesi, Munro, Sansom, and others, even where the arteries were normal.

Traumatic aneurism of the thoracic aorta is rare (Brown, of St. Bartholomew's Hospital, found only eight among 228 aneurisms), since it is better protected than most of the vessels, and the arch is more liable to atheromatous degeneration.

Riesman⁴ reported a case in which there was limitation of motion in the spinal column, with no tenderness over the vertebral spines, but with torturing pains. An exploratory incision was made over a tumor in the back, but finding that the tumor pulsated violently, the operation was wisely abandoned and the wound closed; the aneurism burst later into the left pleural cavity.

A traumatic thoracic aneurismal sac may leak slightly, as in the case which I reported⁵ in which a man sixty-four years of age was injured by a bale of carpet weighing three hundred pounds falling upon his shoulders. He lived two days with a rent in his thoracic aorta one-half inch long. The outer coat or adventitia, however, was not perforated. The inner and middle coats having been torn, the blood dissected its way between the muscular layer and the outer coat throughout the entire extent of the thoracic aorta, and down the abdominal for five inches. The only symptom was the intense pain in the thorax and back, aggravated by every movement, this pain slowly extending from thorax to abdomen. There was no cough. On the second day the outer coat gave way about one inch below the original rent in the inner coats, and the patient died in a couple of minutes from the gush of blood which entirely filled the left pleural cavity. The arch of the aorta was not atheromatous, and in the thoracic aorta the only point of visible atheroma was at the area which gave way.

In aneurism of the thoracic aorta there is usually urgent dyspnea and a sensation of distress and fulness in the chest. In time there is nearly always an erosion of the bodies of the vertebræ, and a rupture may take place either into the mediastinal connective tissue or into the pleural cavity.

Stewart,⁶ Hershey,⁷ and Hunner⁸ report twenty-three

cases treated by this method, and my own makes the twenty-fourth. The article of Hunner is most complete.

Rosenstirn, in an aneurism of the ascending aorta in a member of a rowing crew, first tried iodide of potassium, Tuftall's rest treatment, and barium chloride, then used two feet of No. 28 wire, passing a current of seventy milliamperes for thirty minutes; two years later the man was reported in good condition.

Stewart in his first and unsuccessful case, in a huge aneurism of thoracic and abdominal aorta, occurring in a wrestler, six years' duration, inserted two and one-half feet of No. 23 wire (wound upon a two and one-half inch roll to make spirals), and passed a current of seventy milliamperes for one hour. The sac was firmer on the third day, but ruptured on the ninth. Firm clots were found in all portions of the aneurism, and it was difficult to separate the clots from the wire. He used a needle insulated with shellac varnish, but the coating became softened too much by hot water. The use of carbolyzed glycerin as a lubricant he also found disturbed the insulation. For the negative pad he used a large moist felt plate at the back. In his second and successful case (with Salinger) of aortic and innominate aneurism, size of a foetal head, he used ten feet of No. 30 gold wire, passing a current of thirty to eighty milliamperes one and one-quarter hours.⁹ Galvanism was applied to several wires introduced through hollow needles placed at separate points and connected to the same rheophore. Pulsation and expansion lessened on the second day, also thrill. Four weeks later, second operation in upper part of sac. The patient lived three and one-half years, although he had endarteritis with extensive renal and cardiac disease at the time of operation, was syphilitic and of intemperate habits. He died from a thrombus in the middle cerebral artery. A thoroughly consolidated organized fibrous clot was found deposited about the coils of wire, and the cavity of the sac was completely obliterated.

Stewart's¹⁰ third case was a fusiform aneurism of the abdominal aorta, which was made more prominent by a retroperitoneal tumor, lifting it forward. An abdominal section was done by Drs. Deaver (H. C.) and Neilson, and ten feet of silver wire introduced. A current of fifty milliamperes was passed by the anode for half an hour. On the fifth day the patient died suddenly. Large amount of blood in stomach and upper bowel. A tumor springing from the bodies of eroded vertebrae surrounded the aorta at coeliac axis; thoracic aorta above dilated. There was a small saccular aneurism of the splenic artery. The wire had entered both the saccular dilatation and the dilated aorta, but no clots were found adhering to the wire. The case was evidently not a suitable one for operation.

His fourth case was a syphilitic, who for fourteen months had suffered severe pain in the chest, with pulsating tumor in left posterior thorax. Fourteen feet of gold were introduced. Galvanic positive current applied, increasing from twenty to eighty milliamperes for eighty minutes; imme-

diate diminution of pulsation and great relief from pain and other symptoms for eight and one-half months, when death occurred. No autopsy.

His fifth case¹¹ (with Dr. Noble), a syphilitic drunkard, had suffered from severe abdominal pain for more than a year; was greatly emaciated. Celiotomy done by Dr. Noble, exposing an aneurism of abdominal aorta. Nine feet drawn gold wire, No. 30, introduced; galvanic positive anodal current sixty-five milliamperes passed for an hour. Improvement immediate and progressive, pain lessened, and, all symptoms of aneurism having disappeared, in five months resumed his work. Died at end of nine months of acute dysentery, with no symptoms of return of aneurism.

In another case, a large thoracic aneurism, Stewart introduced wire on three different occasions, with good temporary result. Man died in nine months from rupture of sac.

In another case, seen with Dr. Hare,¹² a syphilitic man with aneurism of transverse aorta, accompanied by pain, dyspnoea, and cardiac disturbance, nine feet of gold wire were introduced through an insulated needle, and the anodal current, seventy milliamperes, passed for an hour. Pulsation and bruit diminished at end of operation, and bruit disappeared at end of forty-eight hours. Five weeks later patient was sitting up without pain. Bruit, pulsation, and thrill had entirely disappeared, cough had ceased, and patient greatly improved. Died seven months later from pressure of sac on trachea.

Hare¹³ reports another case, man, thirty-eight years of age, large aortic aneurism; patient in bed for seven months and had lost sixty pounds. Ten feet of gold wire, current up to 100 milliamperes for one and one-half hours. Contraction of sac and great relief. Second similar operation at end of several months. Died in seven months from rupture of sac. No autopsy. Life prolonged and made much more comfortable.

Hershey¹⁴ reports a case of aneurism of the innominate and aorta which had deep-seated pain in chest beneath and to right of sternum; dyspnoea and bulging. Treated by complete rest; Valsalva's diet; barium chloride, three-quarters grain, three times a day. Later he introduced wire, 14 carat gold, gauge 28; wire snarled in order that it might bunch rather than coil, wrapped on glass vial, placed in clear carbolic solution. Hypodermic needle, 22 gauge, insulated by layer after layer of shellac varnish, each layer set by heat. Thirty-celled galvanic battery; milliamperemeter. Wire kinked after two and one-half feet had been passed. Positive pole attached to wire; negative pole, flat sponge six by eight on on back. Pain in negative electrode considerable. Increased current to seventy, continued for one hour, then diminished to forty. On removing needle, wire was cut and pushed in. Evidences of immediate consolidation; patient able to sleep that night; gain in flesh. Nine and one-half months later was living, with considerable pain in chest, but was able to work. Died at end of a year, rupture of sac.

Kerr, in an aneurism of aorta, inserted ten feet silver wire; galvanic current one-half hour; patient feeling as well as ever one year later.

Kerr, ascending aorta, six feet wire; current fifty minutes; death eighteenth day; firm clot about the wire.

Burresi, ascending aorta, wire No. 30, seventeen inches, current twenty-five minutes; immediate signs of consolidation; death in 100 days.

Barwell, ascending aorta, ten milliamperes, seventy minutes, in twelve hours had signs of consolidation, death on seventh day; had thick, firm decolorized clot in sac.

Roosevelt, aortic; 225 feet steel piano wire, galvanic current, twenty-five milliamperes for thirty minutes. Death on twenty-third day.

Abbe, innominate; 150 feet wire. Current reversed during later part of operation, which tended to disorganize the clot, an error in technique of vital importance as pointed out by Stewart. Death second day.

Halsted. Man, twenty-seven years of age, pulsating abdominal tumor. Celiotomy performed. Five feet of No. 27 wire introduced and anodal current up to 100 milliamperes passed for one and one-half hours. Died in forty hours from rupture into pleural cavity. Wire coils found to have pressed against walls, probably injuriously. Loose, easily detachable coagula upon the wire coils.

Reeve.¹⁵ Aneurism abdominal aorta; epigastric tumor; great pain controlled by large doses of morphia. Celiotomy. Seven feet silver-plated copper wire. Eighty milliamperes for fifty minutes. Patient lived twenty-four hours. One loop of wire was found to have passed ten inches up the aorta, while a single strand had reached the aortic valve of the heart. Aneurism distinctly sacculated; opening into sac one inch in diameter.

Corson.¹⁶ Man, aged thirty-one years; excessive user of alcoholics. Pulsating tumor in neck. Six feet wire. Eight cells of a dry battery for two hours. Partial immediate consolidation. Died on second day. Wire found to have coiled closely in contact with sac, probably because pure silver was used and not drawn wire, which latter coils better.

Finney.¹⁷ (Osler.) Aneurism; thrill and pulsation. Man, twenty-five years of age. Bookkeeper. No traumatism. Celiotomy; pancreas flattened over tumor. Five feet silver copper alloy (75/1000) wire, drawn from No. 8 to No. 27. Galvanic current increasing from thirty to seventy milliamperes; one hour. Thrill disappeared in one-half hour. Sac firmer; had pain after operation; required one-quarter grain morphia every two to four hours. Temperature 103.7° F., caused probably by slough from negative pad on back and infection of abdominal wound. Temperature remained high for two weeks. Died on twentieth day, from hæmorrhage through external wound from slough. Autopsy: Diffuse arterial sclerosis. Opening in aorta one and one-half centimetres in diameter. Aneurism was of the superior mesenteric artery. Wire had entered sac, and one loop had burned side of sac, causing hæmorrhage. Transverse portion of duodenum necrotic, from interference with circulation in superior mesenteric artery, and filled with bloody fluid where oozing had taken place. Clots about the wire and in aneurism fairly firm.

Finney.¹⁸ Man, fifty-one years of age. History negative as regards syphilis. Sternum lifted at each systole. Pulsation extending to right.

Was given nine gelatin injections of 250 cubic centimetres of 1 per cent. solution before operation, and sixteen of a 2 per cent. solution afterwards. Ten feet of silver wire alloyed with copper; current of ten milliamperes for one hour; twenty milliamperes for fifteen minutes additional. Pulsation diminished after third day, but on the twelfth day pain moved towards the left side. Gelatin injections recommenced. Two months later resumed work, but died six months afterwards at sea, presumably from rupture.

Finney.¹⁹ (Osler.) Man, thirty-nine years of age, history of alcohol, tobacco, and syphilis; also a heavy eater. Bulging right side of chest; great cyanosis and dyspnoea. Several aspirations of right pleural cavity; withdrew blood-tinged serum. Diagnosis: Aneurism near the heart or in thoracic portion. Ten feet drawn silver wire alloyed with copper, ten milliamperes, one hour. Patient felt each progressive increase in the volume of the current. Condition improved greatly for fifteen days, but right pleural cavity required frequent aspirations. Similar operation twenty-four days later. Third similar operation nineteen days later. Died eleventh week after first operation, with symptoms of pressure upon trachea. No autopsy.

Finney.²⁰ (Osler.) Man, thirty years of age. Abdominal aorta. Celiotomy. Eight feet of highly drawn wire of sterling silver, ten milliamperes, one hour. Section of the overlying pancreas was avoided by drawing the liver to the right and making the puncture in the upper right quadrant of the sac. Aneurism probably of the superior mesenteric. Greatly improved in symptoms; not much change in physical signs at the date of his discharge from the hospital six weeks later.

In summing up this record, we find that permanent cures are few, as must necessarily be the case in so fatal a condition as aneurism of the aorta, yet in one-half the cases operated upon life was certainly lengthened, and all of those who survived the immediate effects were rendered vastly more comfortable. This result is certainly satisfactory when the fact is taken into consideration that these cases were necessarily fatal ones if untreated.

Ten cases undoubtedly had their lives shortened by the procedure, but several of the patients had fusiform aneurisms and were not proper subjects for the operation.

Rosenstirn's case was alive eleven years after the operation. The post-mortem of one of Stewart's patients made three and one-half years later showed a solidly coagulated tumor. Kerr's case at the end of ten months showed no signs of the aneurism. In Noble's patient all symptoms had disappeared, and another patient died of dysentery nine months after the

operation. Finney's fourth case was at last report living, with great improvement in symptoms. My own patient at nine weeks is too recent to permit of any conclusion save that great comfort and relief from pain and dyspnoea have been secured.

Ten cases then have been positively benefited, one is uncertain, and while the remainder died at various periods within a year, yet nearly all of those that survived the immediate effects of the operation were rendered decidedly more comfortable.

This method, therefore, of dealing with a most serious condition seems to offer a more reasonable hope of success than any other plan at present discovered.

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LEFT CÆCAL HERNIA, WITH A REPORT OF TWO CASES.¹

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THAT the presence of the cæcum in the sac of right inguinal herniæ is not uncommon has been shown by the number of cases reported since the more recent methods of operation have been in such universal use. When, three years ago, I made some investigation as to the frequency of cæcal hernia and classified sixty-three cases (*Journal of the American Medical Association*, June 11, 1898), I was surprised to find that a number of surgeons of long and extensive experience had never found the cæcum in the sac of a hernia. This, I believe, can only be accounted for by the fact that until within the past eight or ten years it was not the custom, in many operations for the radical cure of hernia, to open the sac and examine its contents before reduction. Since the publication of my paper, I have myself met with cæcal hernia on two occasions, and have seen it in the operations of others a number of times. The condition upon the right side, even in femoral herniæ, cannot longer be considered a rare occurrence, although oftentimes representing unusual and interesting pathological features. When the appendix occupies the sac for any length of time, it nearly always becomes adherent, and sometimes is the seat of inflammation rendering operation imperative, and occasionally it perforates and produces abscess formation within the sac.

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The two cases here reported show a rarer form of cæcal hernia, for in each this portion of the bowel was found in the sac of a left inguinal hernia. Of the sixty-three cases above referred to, seven were of the left side, and six of these were irreducible, the condition of the seventh not being mentioned.

CASE I.—S. J., aged seventy years; occupation, engineer. This patient was admitted to the Jefferson Hospital on the night of February 7, 1900, with an enormous left scrotal hernia. The patient said he had suffered from a very large irreducible hernia for several years, and that at twelve o'clock on the day of admission it had suddenly become much larger upon a violent coughing attack, and had given him great pain. The milder methods of reduction had been tried by his doctor without success. On admission, the symptoms of strangulation had set in, and immediate operation was advised. The patient was very stout and had a large and pendulous abdomen. Ether was given, and the usual incision of the Bassini or Halsted operation was made. When the sac was opened, there flowed out about a pint of dark serum. There was a large portion of the small bowel which occupied the anterior portion of the sac. It was very much congested, and in several places was adherent to the sac by old adhesions, showing a long residence in this position. At the posterior part of the sac and tightly constricted in the abdominal ring was the cæcum. The junction between the ileum and the cæcum could be plainly demonstrated, but the appendix occupied a position behind the cæcum and had not made its way into the sac. The condition of the contents greatly improved when the constriction was divided and the whole was returned to the abdominal cavity. The sac was removed, the method of Halsted being employed in the obliteration of the inguinal canal, silver wire being used as a suture. As there was considerable inflammation and an abundance of fat about the sac, I employed superficial drainage. The patient reacted very well from the operation, and, excepting for some superficial suppuration, the wound did well. On the nineteenth day after the operation, when the patient was apparently doing well, he died suddenly in the night from what was apparently heart failure. No post-mortem examination was allowed.

CASE II.—W. W., aged fifty-five years; laborer. This patient was admitted to the Jefferson Hospital, September 18, 1900. He gave the history of having had a hernia since 1877. On admission, the patient had an extremely large left scrotal hernia extending nearly to the knee. Nearly all of its contents could be returned to the abdomen, but when this was done the patient's respiration was greatly interfered with. The patient's urine contained some albumen, numerous leucocytes, and a few blood-corpuscles. Professor Keen, assisted by the writer, operated upon this patient in his clinic on October 1, employing spinal analgesia produced by Eucaïne B. The sac was found to contain a number of feet of small

intestine, the cæcum and appendix, and quite a large portion of the ascending colon. The whole was reduced to the abdominal cavity, producing some discomfort to the patient, and the operation of Bassini was then carried out. The patient reacted very well from the operation, but on the second day it was found that he suffered from a tight stricture of the urethra. For twelve days his temperature remained below 100° F., and his wound healed nicely without suppuration. After this, however, the patient developed symptoms of sepsis, and died of what was supposed to be involvement of his kidneys. (For the privilege of recording this case with my own, I am indebted to Professor Keen, who reported it, under the title of Spinal Anæsthesia, in the *Philadelphia Medical Journal*, November 3, 1900.)

The most interesting feature about these cases is the cause of the condition. Many of the theories regarding cæcal hernia have been revised during the past few years. It was formerly supposed that when the cæcum appeared in the sac of a hernia, it was with only a partial peritoneal covering; but a study of the cases reported has shown that it is extremely rare that a complete peritoneal investment of this portion of the bowel is not found. When the condition appears in children, it is practically always congenital, and due to an attachment between the testis and the cæcum or appendix; occurring in the adult, it is most usually acquired. Of the sixty-three cases which I classified there was not a single case of inguinal hernia, either congenital or acquired, which occurred in the female. Of the nine cases of left cæcal hernia with which I am familiar, but one occurred in a female, and it was of the femoral variety. I think from these facts we can conclude that cæcal hernia is rare in women and that left cæcal hernia is rarer still. The cause of acquired cæcal hernia would seem to be due to two conditions: first, a small but freely movable cæcum; second, a pre-existing hernia of the small intestine. The first of the two cases recorded gives a history which corresponds to that of a number of the cases which have been reported, viz., that the patient has had for a long time an irreducible hernia, that he has had this suddenly increase in size as the result of strain, with the development of the symptoms of strangulation. If the ileum occupies the hernial sac, it can readily be understood that with a large ring, a

movable cæcum, and muscular strain the large bowel could easily be drawn into the sac of the hernia. Transposition of the viscera would be an easy way of accounting for left cæcal hernia, but it is very rare that this condition has existed in the cases reported. It is my own opinion that the most frequent cause of cæcal hernia of the acquired variety, either right or left, is due to a long mesocolon and a pre-existing uncontrolled hernia of the ileum. Treves has shown us that the attachment of the cæcum to the right side of the abdomen is not nearly so firm as was formerly supposed. In an examination of 100 bodies, he was able to carry this portion of the bowel in most instances to the opposite side of the abdomen, and as high up as the liver. It is beyond question that the presence of the cæcum in a hernial sac is frequently the cause of both inflammation and strangulation. Of the sixty-three cases which I collected, twenty-eight were strangulated, two incarcerated, eleven irreducible, ten not stated, and only eleven reducible. These figures, I think, go to show that cæcal hernia is a condition which in all instances requires operation, unless it be in the congenital reducible variety found in children.

THE TREATMENT OF SUPPURATING HÆMATOCELE DUE TO EXTRA-UTERINE PREGNANCY.¹

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EXTRA-UTERINE pregnancy is encountered by the gynæcologist at widely different periods of development, ranging from the fifth week to the ninth month, or even to the condition of missed labor after term. The conditions to be met may differ as widely as the poles, ranging from the tiny, unruptured, non-adherent tube with a living ovum, to a formidable condition with a full-term child and a vascular placenta widely attached to intestine or other non-contractile site. The range is from a simple collection of fresh fluid blood free in the peritoneal cavity and easily washed away, to the enormous encapsulated blood and tumor mass walled in by adherent intestine, omentum, and thick inflammatory sac formation with suppurating contents.

The condition of the patient may be that of the young and vigorous woman in abounding health (one of my patients rode a bicycle the day before I operated and after the preliminary rupture). She may be going about as usual, with only a few cramp-like pains, considered trivial, or she may be, when first seen, in profound collapse, with general sepsis long after rupture and the death of the fœtus.

Quite recently the writer has operated on three of these various types, each requiring different management, and his previous experience covers other varieties of condition. No

¹ Read before the Philadelphia Academy of Surgery, March 4, 1901.

one can lay down a stereotyped treatment for extra-uterine pregnancy, so far as detail is concerned, for the various resources of the surgeon who is accustomed to dealing with complicated abdominal conditions will be taxed to the utmost by some cases. It may, however, be stated that the treatment is distinctly operative. Granted that the conditions be recognized, the day of attempts to kill the fœtus by electricity or other means has probably passed forever.

If the mass found be considered residual, and Nature making an attempt to surround and absorb it, the risk of suppuration or peritonitis still demands immediate operative relief. As to the choice of route, whether vaginal or abdominal, there has been some discussion in recent years. As is well known, certain operators acquire great dexterity in dealing with intra-abdominal conditions through the vagina. A number of these have attempted and a few have advocated the vaginal route for the treatment of the ordinary, comparatively simple recent case. With this plan the writer cannot agree. A number of these operators have encountered difficulty in controlling hæmorrhage, and have had to resort to abdominal section in order to save the patient. There is much likelihood that vaginal hysterectomy might be forced upon the operator to gain room or to control a troublesome hæmorrhage.

Although the writer is accustomed to operating by the vagina for various conditions, and possesses the requisite familiarity with the technique, he would strongly advise the abdominal route only in all cases unruptured, or recently ruptured, as well, of course, as when the child has developed for some months, whether it be living or dead. Where the tube is unruptured, the anatomy is often disturbed and ligation is much surer from above. With free blood in the peritoneum, toilet and ligation are thus best accomplished. With a well developed child, living or dead, the question of vaginal treatment should not arise.

There remains, however, the condition of suppurating hæmatocele from early ruptured tubal pregnancy, or hæmato-

cele which Nature has thoroughly walled in and is trying to absorb. Here, with the diagnosis once clearly established and confirmed by abdominal section, instead of proceeding to break up adhesions and deal with the condition from above, the writer believes that the abdomen should at once be closed and the collection be drained from the vagina. The convalescence will be smoother and safer, as it would be from the vaginal drainage of any pelvic collection with no sac except adhesions. An illustrative case is here given in which this method was successfully carried out.

Mrs. L. D. was admitted to the writer's service at the Presbyterian Hospital, January 19, 1901, with this history: Age, twenty-three years; white; Ireland. Married three years; one child two years old. No miscarriages. Menstruation every four weeks; lasts three to four days, not painful but profuse. No periods missed to date. Four months ago began to have leucorrhœa and obscure uterine discomfort, but periods continued normal. A flow lasting as usual about three days, stopped on December 6, but a few days later violent cramp-like pain in the left lower abdomen began. No fainting or collapse. The flow returned, and has continued daily since, that is about three or four weeks. Quantity, two napkins. Color, red or brown. Some nausea, not in morning. Loss of appetite, flesh, and strength. Patient on admission very pale, skin moist, lips blue, pulse somewhat rapid.

Examination.—Mass fills lower abdomen to umbilicus, highest to the right. Slightly tender. Resonance impaired, but not dull (adherent intestine partly made up its wall). Muscles not rigid. Spleen, heart, kidneys, liver negative. Vagina not blued, but some passive congestion. Cervix rather soft. Uterus appears forward, fundus just above pubis, and closely adherent to large mass below, behind, and above it. Rounded, tense, smooth, firm prominence in Douglas's cul-de-sac, apparently fluid though resistant. This mass could not be displaced, and slight movements of the uterus are independent of it. No mammary signs of pregnancy. Hæmoglobin, 55 per cent.; red corpuscles, 4,560,000; leucocytes, 13,600. The diagnosis gave rise to some speculation among those who examined the case, but as the semisolid, fixed mass, of recent formation, was outside the uterus, as there was constant recent brownish discharge, a rather soft cervix, and a history of recent pain attacks, extra-uterine pregnancy was considered not unlikely. The leucocyte count indicated inflammatory changes in the mass. On incising the abdominal wall, the parietal peritoneum, omentum, and underlying structures were inseparably matted. The incision was therefore extended upward, until in the umbilical region a point was found where the peritoneal cavity could be entered above the mass. A finger was passed around the side of the

omental edge, when the fluid character of the walled-in collection was demonstrated by palpation.

Its upper wall was made up of intestine, the edges of the coils being adherent to one another by the peculiar hard, wooden, inflexible adhesions which betoken the existence of a false sac with inflammatory contents. In front the collection was firmly walled in by omentum and bowel most solidly united to the abdominal wall and bladder. No sign of blood or blood-stain appeared free in the open upper peritoneal cavity, and all the surfaces were here smooth. The suspicions of incarcerated extra-uterine pregnancy were now confirmed.

An experience with a similar case several years before had demonstrated to conviction the extreme difficulty of safely separating omentum and bowel down to the contents of such a sac; the great rigidity of its walls and their inability to collapse when emptied; the ragged internal surface of the sac from adherent, partly organized clot; and the danger of late infection of the upper peritoneum after the sac had shrunk.

This experience occurred in a case admitted to the Methodist Hospital after various attempts had been made by dilating her cervix under ether to deliver her of a supposed full term pregnancy which she did not have. She had been treated by various physicians and was septic. I opened the abdomen above and found one of those incarcerated extra-uterine blood masses described above. I attempted to deal with it from above the pubis, but shall never repeat the effort. In the case now under discussion the abdominal wound was therefore provisionally closed with clamped sutures, without entering the sac, and the posterior prominent vaginal wall was incised. Some pints of decomposing, thin, brown blood with gray purulent streaks escaped, while large black clots of somewhat more recent formation were carefully dislodged. Gentle irrigation. No fresh bleeding. No evident large tubal mass remained. Vaginal drain of gauze and rubber tube. Returning now to the abdominal wound, the sutures were tied without drainage.

A culture made from the contents of the sac developed a pure growth of streptococcus.

The patient did splendidly from the first. The temperature never rose above 99.4° F., and the pulse showed little disturbance after the first day, when its highest rate was 128. The contrast in her condition would have been marked had I separated and stitched the bowel, and after great difficulty packed the cavity from above. As it was, the abdominal adhesion sac rapidly shrank; irrigation was cautiously continued every second day. After the first few days the discharge from the vaginal opening was slight, rather more opaque than mucus is, and never had any odor. The abdominal wound healed primarily. When discharged from the hospital, a small sinus about an inch in depth remained behind the cervix, but was rapidly closing. All that remained of the large abdominal mass was a little thickening behind the uterus, about as large as three fingers. The mobility of the uterus was still impaired. The patient was entirely without discomfort or symptoms, and her hæmoglobin had increased from 55 per cent. to 65 per cent.

While this is but a single case, it must be recalled that this form of incarcerated blood collection is not very frequently met. It is indeed remarkable how Nature proceeds to wall in the blood, absorbing any which may have strayed, so that on opening the abdomen not a sign of blood or blood-stain appears until a very complete wall of intestine, omentum, and lymph is broken down. When the collection is not too great, it will be walled in entirely behind the uterus, as beautifully illustrated in a case operated upon at the Methodist Hospital. There the clot filled the pelvis as high as the fundus of the uterus, the edge of the adhesion wall being attached across the top of that organ, leaving the bladder free to dilate. The broad ligaments were stretched outward and then backward, exactly as though the tubes had been held out like arms. The fimbriated ends curved inward. Towards the diaphragm the colon was densely adherent, while in front of all the small intestine and omentum were attached. A strong sac had formed around the blood-clot, which was of the size of two fists. This sac could be peeled off the peritoneum at some points, but not all. Separation of adhesions was difficult, and some bowel stitching was required. As the emptied sac would not collapse and could not be entirely removed, a Mikulicz gauze-bag drain was packed into it and brought through the parietal wound. This case was not suitable for vaginal treatment, because the left tube was much distended by the pregnancy, apparently containing a mass which it would have been dangerous to leave.

This patient was thirty-three years old, had had seven children, and a miscarriage only five months before. She had had regular periods since the last, so called, two weeks before operation. The history of pain attacks and irregular bleeding lasted about four weeks. She is now in excellent condition, pulse 78, but will require careful draining for some time, owing to bowel-wall infiltration and ragged sac interior.¹ Another case of ruptured extra-uterine pregnancy I operated upon nine days ago, also at the Methodist Hospital. She

¹ Patient made a complete recovery.

may be mentioned here by way of contrast with the other cases. The diagnosis was easy and was made before operation. The patient was twenty-three years old, and had never before been pregnant. The blood-clot, about ten or twelve ounces, was free in the peritoneal cavity. It was readily removed, the adhesions separated; the left tube and ovary, shown in the specimen, tied off, and the abdomen closed without drainage. She also is doing finely, with a pulse about 76.¹

Where suppuration is going on, as in the first case described, it is quite certain that the foetus is dead, and that further hæmorrhage will not occur. In the early stages of ruptured extra-uterine pregnancy, of course, successive hæmorrhages are the rule, and for that reason the only good treatment includes thorough ligation of the affected area.

Vaginal incision and drainage I consider, therefore, only adapted to a very few cases, which have been thoroughly walled in, where there appears to be no undrained tube mass, and where previous abdominal exploration has demonstrated the strong incarceration of the clots. All other cases should be dealt with exclusively from above. The recognition of these suppurating incarcerated cases, and their distinction from tubal and ovarian abscess, or adherent retroversion with incarcerated intra-uterine pregnancy, will always present some difficulty. The leucocyte count will be high in the first two conditions and low in the last named. In the hæmorrhage cases, a low red-cell count and the physical appearance of anæmia suddenly established will be helpful.

It may be of interest to note that in the three recent cases referred to in this report, there was no instance of a missed period, all of the ruptures being probably in the early weeks. Not one of the patients had actual collapse. In two of the cases the walls of the tube had not ruptured, but the hæmorrhage had escaped from the fimbriated end of the distended tube.

¹ Patient made a complete recovery.

THE MORTALITY OF OPERATION FOR OBSTRUCTIVE JAUNDICE.¹

By JOHN B. DEEVER, M.D.,

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THE following is the classification of causes of obstructive jaundice by Murchison, "Osler": (1) by foreign bodies within the ducts, as gall-stones and parasites; (2) by inflammatory tumefaction of the duodenum or of the lining membrane of the duct; (3) by stricture or obliteration of the duct; (4) by tumors closing the orifice of the duct or growing into its interior; by pressure of the duct from without, as by tumors of the liver itself, of the stomach, pancreas, kidney, or omentum; (5) by pressure of enlarged glands in the fissure of the liver, more rarely by abdominal aneurism, a fecal accumulation or the pregnant uterus; (6) to these may be added lowering of the blood-pressure in the liver, so that the tension in the smaller bile-duct is greater than in the blood-vessels. In this class very probably may be placed the cases resulting from mental shock or depressing emotions.

Of the above causes of obstructive jaundice, I have only met with those caused by calculous obstruction of the hepatic and common or of the cystic ducts, where the stone was located at the junction of the cystic and hepatic ducts with obstruction of the latter; stricture and angulation of the common duct caused by adhesions which were making either pressure or traction; pressure on the common duct from carcinoma of the head of the pancreas, either alone or in connection with cancer of the duodenum. A condition to which my

¹ Read before the Philadelphia Academy of Surgery, March 4, 1901.

attention has been drawn, upon more than one occasion, is the association of attacks of jaundice with very movable kidney, and I have been inclined to attribute this in part, at least, to traction upon the peritoneum, and consequent angulation of the common duct.

The cause of death in the cases which I have lost were consecutive and secondary hæmorrhage, exhaustion, and cholæmia. I have, with one exception, been fortunate enough to have had autopsies in these cases, and therefore have been able to rule out peritonitis as the cause of death.

Mayo Robson (*Disease of the Gall-Bladder and Bile-Ducts*, Second Edition, 1900) reports twenty-two deaths following operation for the relief of obstructive jaundice. Of these, seven died as the result of hæmorrhage either consecutive or secondary; five of exhaustion; four of shock; three of heart failure, one of which was complicated by nephritis; one of an abscess between the liver and diaphragm, which was not discovered at the operation; two of peritonitis, in one of these a small hole was torn in the colon by the breaking up of dense adhesions, and in the other a ligature, which had been used to tie off the cystic duct in amputation of the gall-bladder, slipped and caused extravasation and peritonitis. It would seem therefore that his experience coincides with my own, and that peritonitis is not a common factor in the mortality. It is a question with me if most of the cases which die of exhaustion or heart failure are not in reality cases of cholæmia. Shock cannot be separated from hæmorrhage as a cause of death, for it is the loss of blood, either at the time of operation or following it, that causes the shock.

From the present status of surgical interference for obstructive jaundice, it should not have the mortality credited to it from either of the causes mentioned, as I will try and show later on.

Neither consecutive nor secondary hæmorrhage should occur, and particularly consecutive hæmorrhage. The latter is due, pure and simple, to the blood changes consequent upon the prolonged jaundice. The exact changes which take place

in the blood, I believe, have not been definitely determined. It is probable, however, that there is some chemical change which inhibits the fibrin-forming element, and thus prevents rapid coagulation. The ordinary blood-counts indicating anæmia, hæmoglobinuria, leucocytosis, etc., do not account for the tendency to hæmorrhage in obstructive jaundice. The effects of the bile salts on the blood-vessels must also be taken into account. There seems to be a relaxed condition of the arteries which interferes with their proper contraction, thus encouraging free bleeding.

I have met with but two cases of secondary hæmorrhage, and in each of these there was a period of consecutive bleeding preceding the onset of secondary hæmorrhage, and which was controlled only after the wound had been packed with gauze. In both of these cases the gauze packing introduced to control the consecutive bleeding was removed on the seventh day, the removal being effected without difficulty and with practically no pain. In one case, three days after the removal of the gauze, secondary bleeding occurred, costing the patient her life. The same may be said of the second case, except that it was only by the most heroic efforts that her life was saved. Intravenous saline transfusion given by my house surgeon, Dr. Moore, upon two different occasions, full doses of opium, absolute rest of the stomach, nutritious enemata, etc., were the means to which we can ascribe her recovery.

I have seen but one death from consecutive hæmorrhage alone. This patient died within twenty-four hours following the operation. The control of primary hæmorrhage by means of the ligature is certain. I have never been unfortunate enough to wound the portal vein or any large vessel. To guard against consecutive bleeding, chloride of calcium in thirty-grain doses for three or four days before as well as after operation, as recommended by Robson, I believe good practice; yet, I am sorry to confess, I have not been able, in my comparatively limited experience, to attribute much good to it. A wider experience and greater familiarity with its use may perhaps convince me of its utility and benefits. Supra-

renal extract has lately taken a place as a hæmostatic, and in one of the cases herein reported it was tried with seeming success.

Obstructive jaundice due to gall-stones is usually due to obstruction of the common or hepatic ducts; it may, however, and in fact frequently does, occur when the gall-stones are confined to the cystic duct or gall-bladder. Here the obstruction to the flow of bile is due to the associated cholangitis. This is a rather favorable condition of affairs for operation, as the removal of the gall-stones from the cystic duct or gall-bladder will be followed by a rapid subsidence of the inflammatory swelling of the common duct. Reidel (*Gumprecht, Deutsche Med. Work*, 1895, No. 15) says that two-fifths of the cases of jaundice in cholelithiasis arise in this way.

Drainage plays an important part in the above result; this is probably accounted for by the fact that the valve-like action of the reduplication of the mucous membrane lining the cystic duct is overcome by the obstruction to the flow of bile, and the slow regurgitation becomes a steady flow of bile into the gall-bladder, and the drainage provides for the escape of the excess.

There is a class of cases where the inflammation in and about the gall-bladder is so intense that the surrounding tissues and organs become gangrenous, and the patient succumbs to the exhausting effects of local and constitutional sepsis. The following case is an illustration:

C. P., aged fifty-three years; for several years prior to present attack has had "bilious attacks" without jaundice or pain. Present attack began five weeks before admission to German Hospital, December 4, 1900. He had pain in the region of the gall-bladder radiating to shoulder; he was tender over the gall-bladder, but was not jaundiced. He continued his occupation for two weeks. Three weeks prior to admission, the pain and tenderness became more aggravated, and jaundice made its appearance for the first time. The jaundice has gradually increased until the present time; bowels constipated; the gall-bladder was enlarged, and upon deep pressure tenderness could be demonstrated.

Operation.—The gall-bladder was enlarged and tied to the liver by dense adhesions. It contained many large stones, pus, and bile, and its

walls were ulcerated and friable. The common and cystic ducts presented the same condition as the gall-bladder and contained many stones; there was one stone in the hepatic duct. The stones were all removed and the cavity packed with gauze and drained. On the sixth day the gauze packing was removed, liberating a considerable amount of pus; the tissue about region of the gall-bladder was necrosed, and a large pus cavity led down behind the liver. He died of exhaustion due to local and constitutional sepsis.

Post-mortem.—Localized fibrous peritonitis, no involvement of general peritoneum.

A careful study of the causes of the mortality of obstructive jaundice leads us naturally to the consideration of the best methods to adopt to combat the disease. Shall we treat them as medical cases, with the prospect of surgical help if medical measures fail, or shall we treat them as purely surgical cases? And if so, how and when? If we take the six causes for obstructive jaundice, we can see that two, namely, inflammation to the flow of bile is due to the associated cholangitis in blood-pressure, are purely medical cases, while in the other four the indications are distinctly and positively surgical.

The most common of all causes, and more common than all the others put together, is obstruction from gall-stones. Parasites are so rare that they can be passed by with the mention, although the indication here is distinctly surgical. Every case of cholelithiasis that I have operated upon has given a history of repeated attacks treated medically, yet have not been cured of the disease or freed from its dangers. Each succeeding attack is accompanied by local and systemic changes which detract from a favorable surgical prognosis. We have seen that the most common cause of death is hæmorrhage caused by changes in the blood; that the next most common was exhaustion, or what we believe to be cholæmia, and third, most common, shock which is a result of hæmorrhage, and that these three causes are undoubtedly enhanced by delay or long continuance of the pathological factors of the disease.

It would seem, then, that operation, and early operation, offers the best safeguard to the destructive possibilities of obstructive jaundice due to cholelithiasis. Strictures or ob-

literation of the duct; tumors closing the orifice of the duct or growing into its interior; pressure from without by tumors of contiguous organs, or by enlarged glands in fissure of the liver, present indications so unmistakably surgical that it is hardly necessary to argue the point.

Marked jaundice, and especially if of long duration, offers a serious obstacle to operative interference, and yet in some cases we must assume the increased risks. The class of cases in mind is the fulminating type of the disease; they run a course similar in onset, duration, and termination of the attack to the fulminating form of acute appendicitis. A differential diagnosis is oftentimes difficult to establish; yet the one most important fact can be established as a rule, *i.e.*, general peritonitis, which is the usual accompaniment of fulminating appendicitis and unusual in the case of the biliary apparatus. In either case operation should be synchronous with the establishment of a diagnosis, or even with a strong suspicion of the trouble; under these circumstances it is better to open an abdomen and find little or nothing wrong, than to do so later on in the attack and find an irremediable condition of affairs.

The time which elapses between the onset of an attack of fulminating obstructive jaundice and its fatal termination is, at the most, a very few hours; and even in this short time it is usual to find gangrenous destruction of not only the gall-bladder and ducts, but of the contiguous organs and tissues, and especially the duodenum and liver. Here the only hope is prompt relief of the obstruction and adequate drainage.

The important fact to be learned by this paper, and which to me seems to be the only logical deduction, is that early operation not only in the acute exacerbation of the disease, but in the early days of the disease itself, not only offers the best and surest prognosis as to recovery, but as to the mortality as well.

The five cases reported in this paper are used as a text; they represent the mortality of this affection in the German

Hospital during 1898, 1899, 1900, and for January and February, 1901.

A. W., operated in 1898. Obstructive jaundice. Stone in common duct; had consecutive hæmorrhage, which was controlled by packing; four days after operation a secondary hæmorrhage occurred, and, in spite of packing, she died of shock due to hæmorrhage.

C. L., operated in 1899. Obstructive jaundice. Urine loaded with bile. Gall-bladder enlarged and filled with sanguineous pus; five stones removed from gall-bladder and one from cystic duct. Patient died of exhaustion two days after operation.

C. P., aged thirty-eight years; married. Diagnosis, cholelithiasis. Admitted May 22, 1899; discharged May 27, 1899; result, death. Father, mother, one brother, and three sisters living and well; uses alcohol very moderately; married thirteen years; two living children, two died in infancy. Had usual milder diseases of childhood, had enjoyed excellent health up until three years ago, when he had an attack of enteric fever. Present trouble began one year ago, although he had not been feeling well since his attack of enteric fever two years before. Has lost fifty pounds within the past two years. The present trouble began with severe cramplike pain in the hypochondriac region. These remained localized in the position, and did not radiate. At the same time he became nauseated, and for several days continued to vomit small quantities of biliary material. At this time he was confined to bed for a period of ten days, although his pains had greatly moderated after the fourth day of onset of the symptoms. During this period, and for an indefinite time thereafter, his stools, which were infrequent, were of various colors, varying from a light grayish clay color to dark brown. During this attack his skin became yellow, but gradually faded out until he became perfectly white again. Urine was at times of a deep brown color, staining his underwear. After a time he became better and finally resumed his work, and continued at it until last November (1898), when he again had a similar attack with pain, biliary vomiting, constipation, and jaundice, differing only from the former one in severity. This attack did not confine him to bed; but since then he has never been free from jaundice or pain and tenderness over the region of the gall-bladder. During the next four months he continued moderately jaundiced, but does not know whether his jaundice moderated or became more intense at times. His stools were of a variable color, at times clay colored, at others of a deep brown color.

His present condition began four weeks ago with severe pains in the left hypochondrium, followed by nausea and biliary vomiting. Fæcal passages and urine had the above mentioned characteristics. This attack, like the preceding one, did not confine him to bed, but prevented him from continuing at his occupation. His pain (although moderate) and soreness in the region of the gall-bladder have continued until his admission to the hospital. His jaundice was gradually becoming more intense.

Upon admission, temperature and pulse are normal. Has the above symptoms, with slight tenderness upon deep pressure just below the costal

arch, three inches to the right of the median line. It seems that faint gall-stone crepitus can be felt in this position. Gall-bladder and area of liver dulness are not enlarged.

Operation, May 24, 1899. Patient prepared and etherized, using 480 cubic centimetres of ether. An incision through the rectus muscle. The gall-bladder was partly visible and projected slightly below the inferior hepatic border; it was only slightly distended. The peritoneal cavity was packed off with wet, hot sterile gauze, and the region of the gall-bladder explored by the finger. The finger inserted in the foramen of Winslow disclosed a large stone about the size of a pigeon's egg, occupying a position in the common duct, behind which the cystic duct and gall-bladder were slightly distended with bile. An incision about one and one-half inches in length in the common duct released the stone and many smaller triangular ones which had collected in the duct. The duct was then mopped out with iodoform gauze and the incision closed with a row of continuous sutures. The area just behind the common duct was drained by rubber tubing and two pieces of gauze. The gall-bladder was opened by an incision barely large enough to admit a small rubber drainage tube; the latter was packed around with two strips of gauze, the tube emerging at the lower end of the abdominal incision. The tube draining the area behind the common duct came out just below it. The gauze packing was removed and abdominal wound closed by interrupted, through-and-through silkworm-gut sutures, silver foil, and iodoform gauze dressing.

May 25, 1899. Abdomen greatly distended, not tender. Distention diminished after turpentine enema. Pulse very feeble. Facies drawn and pinched.

May 26, 1899. Pulse has become more feeble and at times barely perceptible, skin cold and clammy. Patient has begun to vomit small quantities of greenish material. This has kept up without interruption during the day. Delirium in a mild form has set in, and altogether patient is in a very poor shape. Abdomen greatly distended and tympanitic; hepatic area of dulness not marked.

Partial Postmortem.—Localized fibrinous peritonitis; no pus in general peritoneal cavity. Death probably due to cholæmia.

W. J. P., aged fifty-four years. Diagnosis, gall-stones. Operation. Admitted January 26, 1901; discharged February 4, 1901. Result, death.

Mother living and well. One brother died of enteric fever; one brother living and well. One son and one daughter living. Wife living. No history of carcinoma or phthisis.

Patient was very weak when admitted. He was emaciated, exceedingly nervous, extremely jaundiced, no fever, and fair pulse. His illness began in February, 1900, with a diagnosis of catarrhal jaundice. Gall-stones were considered, but he never had pain in any way resembling biliary colic. In the following May he was improving from the attack, and had a slight attack of colicky pain lasting twelve hours, which suggested biliary colic. After this he began to fail; he lost flesh, had

marked anæmia, leucocytosis, constant nausea, and appearance of cachexia. Malignant trouble was positively diagnosed.

In July he had a second attack of colicky pain of short duration, followed by rapid improvement. He gained weight, was free from jaundice, and he thought he was cured, when on his return to Philadelphia, in November, the jaundice, weakness, loss of flesh, and nausea returned. Gall-stones were diagnosed. Operation was considered, but was deferred, hoping for improvement. He steadily lost ground until he was admitted on January 26 with above symptoms and leucocytosis of 15,400. Pruritus was marked and distressing.

Three days after admission he was operated under ether anæsthesia. Incision was made through the right rectus muscle into the peritoneal cavity. The gall-bladder was felt to be smooth, not markedly enlarged, and the seat of a large stone. The intestines were walled off with gauze. The gall-bladder was opened on the anterior surface and a large stone (of size of first joint of thumb) was removed. The stone was free. Another stone was felt in the common duct. This was also movable. It was removed by making an incision into the common duct. A rubber drainage tube was placed into the gall-bladder and through the opening in the duct, and was held in place by a chromicized catgut ligature.

A piece of iodoform gauze was placed under the gall-bladder and left in. The large pieces of gauze were removed, and the wound was closed by through-and-through silkworm-gut sutures, except at the upper part, where the two tubes and gauze were placed.

He did well for two days after the operation; his mind was clear and alert, pulse and temperature good. He slept fairly well, expelled flatus, and took nourishment. There was slight but continual oozing of blood from the wound and a free discharge of bile. He could not urinate voluntarily. The next two days he became nauseated, restless, passed scanty amounts of urine, pulse more rapid, mind not so clear. The slight oozing from the wound was not checked by packing; the gauze was removed on the third day after, but the oozing continued. It was checked at once with a 1 per cent. solution of suprarenal extract.

On the fourth day he became delirious, semicomatose; pulse was weak; was nauseated with occasional vomiting; abdomen was flat, and he passed flatus. He was transfused, with temporary improvement for twelve hours, at the end of which time he was again transfused. After repeated enemas he had a slight bowel movement on the fifth day. After this he gradually sank, and was unable to take food by mouth or rectum; pulse could not be felt; was semicomatose; extremely jaundiced; pruritus marked even in delirium, vomited, and unable to retain anything by rectum.

He died while in this condition. Wound healed beautifully. Permission for an autopsy was refused. This was, I think, a death from chœmia.

The cases of death reported by Mayo Robson are as follows:

No. 283. Obstructive jaundice. Several loose stones in common duct. Cause of death was violent and persistent hæmatemesis. Death on second day after operation.

No. 264. Obstructive jaundice for months. Pressure from cancer of pancreas. Died on fourth day of cardiac failure. No peritonitis.

No. 178. Obstructive jaundice. Common duct thickened and contained gall-stones. Death from exhaustion and shock on third day.

No. 149. Obstructive jaundice. Four months. Cancer of pancreas and common duct. Death from intraparietal and intraperitoneal hæmorrhage without peritonitis. Lived one week.

No. 141. Obstructive jaundice. Cholelithiasis; eighteen stones, dense adhesions. Gall-bladder removed. Ligature slipped on second day. Extravasative peritonitis.

No. 243. Obstructive jaundice. Stone in ampulla of Vater; removed through duodenum. Pus collection between liver and diaphragm. Not discovered until autopsy.

No. 255. Obstructive jaundice. Stone in common duct and one in ampulla. Well until fifteenth day; died on seventeenth day of heart failure. No peritonitis.

No. 277. Obstructive jaundice. Stone in common duct, which was immensely distended. Numerous adhesions; violent hæmatemesis twelve hours after operation.

No. 272. Obstructive jaundice. Stone in gall-bladder; two stones in common duct. Many adhesions. Persistent vomiting, and death from exhaustion on fourth day.

No. 236. Obstructive jaundice. Stones in common duct; hepatic duct and cystic duct removed. Patient died on sixth day of heart failure and exhaustion.

No. 177. Obstructive jaundice. Stone in common duct removed by incision and duct sutured. Died at end of five weeks from exhaustion.

No. 59. Obstructive jaundice. Stone in common duct; adhesions removed; incision and then suture. Death from peritonitis due to fæcal extravasation from a small hole in colon caused by adhesions.

No. 250. Obstructive jaundice. No stones or tumor felt; cirrhosis of liver and some swelling of head of pancreas. Disease probably cancer of papilla and subsequent cholangitis. Died of shock and exhaustion on third day. No autopsy.

No. 274. Obstructive jaundice. Cholelithiasis. Patient weak, and no attempt to remove stones. Bladder drained. Died on second day. Hæmorrhage, which was in the form of persistent oozing.

No. 143. Obstructive jaundice, with hæmorrhage from various localities. Stricture of common duct. Death from hæmorrhage and shock in twenty-four hours.

No. 51. Obstructive jaundice. Distended gall-bladder, no stones; head of pancreas hard. Died of shock on second day.

No. 33. Obstructive jaundice. Cancer of pancreas, with gall-stones. Hæmorrhage of nose, bowel, etc. Died of shock promptly.

No. 11. Obstructive jaundice. Cancer of pancreas, distended gall-bladder. Death on ninth day of hæmorrhage.

No. 235. Obstructive jaundice. No stones in gall-bladder or common duct. Death in seven days, of syncope. Kidneys granular and capsule adherent. No peritonitis.

No. 159. Obstructive jaundice. Adhesions, gall-stones, and infective cholangitis. Death from general oozing at site of torn adhesions.

No. 92. Obstructive jaundice. Eighteen stones from ducts; infective cholangitis, adhesions. Death on twelfth day; exhaustive, persistent vomiting. No peritonitis.

Richardson, in a paper read before the Surgical Section, meeting of American Medical Association, 1900, reports thirteen deaths in cases of biliary calculi and about 100 recoveries. He claims that early operation is not attended by any mortality, but the fatal cases were those operated late or after cholæmia had become a factor.

REPORT OF A CASE OF RECOVERY FROM PERFORATING TYPHOID ULCER OF INTESTINE AFTER OPERATION.

By WILLIAM JONES, M.D.,

OF PORTLAND, OREGON.

PROFESSOR OF CLINICAL SURGERY IN THE UNIVERSITY OF OREGON; VISITING SURGEON TO ST. VINCENT HOSPITAL.

Miss N., aged twenty years, came to St. Vincent Hospital on September 27, 1900, having been sick with typhoid fever for about one week. The fever ran a severe course, the temperature ranging high. During the fifth week the temperature began to decline, and became normal in morning and 101° F. in evening for two days. On October 20, at 5 P.M., while voiding urine into a bed-pan, she was seized with a sudden, severe pain in the lower part of her abdomen, a little to the right of the median line. At 6 P.M. she had a chill lasting an hour, during which time she vomited frequently. At 9.30 P.M., Dr. H. W. Moore, her physician, visited her and found her temperature 103° , pulse 140, body covered with a profuse clammy perspiration. There was an anxious expression of the face, flexion of the thighs, and great pain and tenderness over the entire abdomen, more marked over lower right quadrant. Dr. Moore recognized the presence of intestinal perforation and the necessity of an operation at the earliest possible moment. The absence of the patient's parents prevented immediate surgical interference.

At 9 A.M., October 21, I saw patient in consultation with Dr. Moore. Her temperature was then 100° , pulse 140, and very weak. Her parents having been communicated with, an immediate operation was decided upon, though her condition seemed almost hopeless. Preparations were hastily made, and with the assistance of Dr. Moore I performed abdominal section by a median incision below the umbilicus.

On opening the abdomen there was a free escape of gas. There was present a large quantity of seropurulent fluid containing flakes of a yellowish exudate. Just above the bladder the coils of the intestines were loosely adherent to each other. They were examined for perforation, but none was found. The intestines were extensively coated with a yellow exudate. The appendix, which was also coated with this exudate, was quickly removed, but, except for its peritoneal covering, was in a healthy condition. Septic fluid filled the pelvic cavity and bathed the intestines

over the right half of the abdomen, also the under surface of the liver. A hasty examination failed to discover the perforation, and we decided not to continue the search longer, but to treat the case as one of diffuse purulent peritonitis. Accordingly, the whole infected area was irrigated with hot salt solution, and drainage provided at the median incision by wicks of gauze wrapped with rubber dam, and in the right lumbar region by large rubber tubes passing to the under surface of the liver and downward towards the pelvic cavity. These measures were carried out with the greatest possible speed. Patient left the table apparently no weaker than at the commencement of the operation, and soon began to rally. On the second day there was a free discharge of faecal matter from the median incision; this discharge continued abundant for two or three days, then diminished, until at the end of a week it had nearly ceased. During this time the temperature was nearly normal. At the end of a week there was a relapse of the typhoid fever, and a little later faecal matter began to discharge freely from the fistula; the fever continued for three weeks. From this time the convalescence was uninterrupted. The faecal fistula closed spontaneously and completely. The patient made a complete recovery.

The points I would make are:

- (1) Operation holds out some hope, even in an apparently hopeless case.
- (2) Make the operation as short as possible, and only do what is absolutely necessary to meet the indications of the moment.

In this case the search for the perforation was deliberately abandoned when it was not readily found; her condition would not permit of prolonged anaesthesia nor of much manipulation of the intestines.

The indications were to give free vent to the septic fluids and limit the extension of the septic area. The discharge of faecal matter through the infected area and the external wound would not add materially to the quantity or virulence of septic absorption. The closure of the perforation would not have added greatly to the prospect of the patient living, while a prolonged search would have been almost certainly fatal.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, February 13, 1901.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

STRANGULATED HERNIA; OPERATION UNDER LOCAL ANÆSTHESIA.

DR. ARTHUR L. FISK presented a man, sixty-one years old, who entered hospital, with a double inguinal hernia, on November 19, 1900, complaining of considerable pain in the hernia on the right side. He was also suffering from a severe chronic bronchitis.

The case was regarded as one of incarcerated hernia, and the patient was kept under observation for twenty-four hours. He then had a severe attack of vomiting, the vomited material containing much fæcal matter. On account of the condition of the man's lungs, it was decided to operate at once under local anæsthesia. After the administration of a hypodermic of morphine (one-eighth of a grain), about four drachms of a 1 per cent. solution of cocaine were injected along the line of the proposed incision, and the right hernia was cut down upon. At the neck of the sac, a strangulated knuckle of intestine was found; as it was in good condition, it was released and returned to the abdominal cavity. The wound was then closed and the man made an uninterrupted recovery. He suffered little or no pain during the operation, and was so well pleased with the result that a month later he requested that his hernia on the opposite side be operated on. This was done on December 24th last, also under local anæsthesia. His recovery was uneventful.

INTUSSUSCEPTION.

DR. F. KAMMERER presented a little girl who came under his observation last August. There was nothing of interest in

her previous history. The mother stated that the child had eaten some watermelon, and on the following morning, while going down-stairs, she had an attack of cramps. This repeated itself at short intervals, and soon afterwards a bloody discharge was noticed from the anus; in addition, there was rectal tenesmus and vomiting, the picture being a typical one of acute intussusception. These symptoms were allowed to continue without any effort at relief until nine o'clock in the evening of the following day, when the patient was brought to the hospital, where Dr. Kammerer saw her two hours later, that is, about forty hours after the onset of her symptoms. He found the abdomen slightly distended; it was not painful, and over the left side a large, sausage-shaped tumor could be distinctly made out; the apex of the intussusceptum could also be felt per rectum. The child's temperature at this time was 100.5° F. She had ceased to vomit.

Dr. Kammerer said he immediately did a median laparotomy, making a very liberal incision. In this case, as in three previous cases which had come under his observation, he found it necessary to evert most of the intestines before reaching the invaginated portion of the gut. It proved to be of the ileocaecal variety, and no difficulty was experienced in reducing the invagination up to the caecum, but the reduction of the caecal portion was rather difficult. The abdomen was then completely closed, and the patient made an uneventful recovery.

Dr. Kammerer said the case was rather unusual, as it proved that even after forty hours a good result might sometimes be obtained by operative interference. This should not, however, be taken as a plea for late operative interference.

EMPYEMA; INCISION OF PULMONARY PLEURA.

DR. CHARLES N. DOWD presented a boy of nine years, who, in February, 1900, had an attack of pneumonia, which was followed by empyema. When he was admitted to St. Mary's Hospital for Children the pus had broken through the chest wall and caused a bulging between two of the lower ribs anteriorly. Twelve ounces of pus were immediately evacuated at this point, and on the following day a portion of the seventh rib was resected near the posterior axillary line. The case was then dressed with care, and efforts made to expand the lung for about three and

one-half months. At the end of that time there was still a very large sinus leading up to the apex of the lung, and a localized abscess had pointed between the second and third ribs in front.

As the child was not doing well after this long treatment, a secondary operation was done. About three inches of the ninth rib, and smaller portions of the ribs above this as far as the third, together with a corresponding wedge-shaped piece of costal pleura, were removed. This gave a very good exposure of the thickened pulmonary pleura, through which an incision about four inches long was made, and the pleura pushed back from each side. The lung was then seen to expand to a considerable degree, but not as satisfactorily as Delorme describes in speaking of his cases. He states that after his incision the lung expands as an animal's lung does when it is inflated. Drainage was carried from the anterior opening between the second and third ribs to this large lateral opening.

After recovering from the immediate effects of the operation, the boy was sent to the country branch of the hospital at Norwalk, Connecticut, where he could have the advantage of good hygienic surroundings and out-of-door life. The wound healed promptly there, about eight months ago, and has not opened again.

There is a good respiratory murmur over the affected lung, and he uses that side of his chest well in breathing. He has no noticeable lateral curvature of the spine. He shows no sign of tuberculosis, although the long delay in healing suggested such a cause.

Dr. Dowd said this was the third case in which he had incised the pulmonary pleura. One of the cases was complicated with miliary tuberculosis and the lung did not expand. In that case the pleura could not be peeled from the lung tissue and the operation was without benefit. In the second case the pleura was very thin and the lung expanded satisfactorily. The case promised very well at first, and the wound healed, but opened again at a later time, and the patient has since developed tuberculosis in other regions of the body.

In reply to a question, Dr. Dowd said his operation differed somewhat from the Delorme method in the removal of a portion of the chest wall instead of lifting it as a flap and then returning it to its position.

ADENOFIBROMA OF THE BREAST.

DR. DOWD presented a colored girl, fourteen years of age, from whom a tumor of the breast was removed by him about two weeks before. It was the size of a goose-egg, and freely movable between the glandular tissue and the skin, being apparently entirely outside of the breast tissue. It was hard to the feel, and no other growths could be made out either in that breast or the opposite one. It had been noticed for about a year. Upon operation it was found to be distinctly encapsulated, and was shelled out with perfect ease. It proved to be an adenofibroma.

Dr. Dowd said that adenofibromata of the breast are ordinarily found as scattered nodules throughout one breast or both, and they are usually incorporated in the breast tissue. Thirty-seven cases similar to this have been collected from Von Bergmann's clinic by Schimmelbusch (*Archiv für klinische Chirurgie*, Band xlv, Heft 1, p. 102, 1892); and in reviewing them attention was called to the points above mentioned. They are distinguished by their mobility, their hardness, their separation from and non-involvement of the surrounding tissues, and the fact that they are in no sense malignant.

The microscope shows that instead of there being one layer of epithelial cells in the tubules of this tumor, there are several, and in certain parts of the tumor the epithelial elements are found in such profusion that it even suggests carcinoma.

The location of the tumor between the breast and the skin, in its own capsule, suggests the possibility of its development from one of the little portions, or sequestrations, of breast tissue which are often found about the gland.

TYPHOIDAL OSTEOMYELITIS, WITH MULTIPLE LESIONS.

DR. GEORGE E. BREWER presented a young man who entered the City Hospital about eighteen months ago suffering from a number of painful lesions on both legs. His history was that during the Spanish war he had contracted a severe attack of typhoid fever in Cuba, and he spent some time in the hospital there and afterwards in New Orleans. Subsequent to this he developed pains in both legs, which became so severe that he had to give up his work.

At the time of his admission to the City Hospital, eight distinct lesions were made out, two of which were accompanied by slight enlargement of the bone. Four of the lesions were on one leg, involving the tibia and femur, and three on the other. There was also a thickening of the first phalanx of one finger on the right hand. Five of the lesions were freely incised, disclosing circumscribed cavities in the bone varying from one-quarter to half an inch in diameter, and filled with granular matter. There was also some thickening of the periosteum and considerable periostitis. Most of the lesions which were operated on healed very promptly. The lesion on the finger was not opened, and finally broke down. The patient still complains of pain in the femur from time to time, especially when he is exposed to the weather or is run down in health.

DR. FISK said that a year ago he saw a case of typhoidal osteomyelitis in which there were four lesions, one over the crest of the right tibia, another over the ninth and tenth ribs on the right side, a third over the supraspinous process of the right scapula, and the fourth over the left hip. The lesions were incised and cleaned out, and the patient made an excellent recovery.

PLASTIC OPERATION FOR ŒDEMA OF ARM DUE TO CIRCUMFERENTIAL SCAR.

DR. ELLSWORTH ELIOT, JR., presented a man who about two and one-half years ago received extensive burns involving the left upper arm and shoulder. He was treated at the New Haven Hospital, the raw surfaces being covered by skin-grafts. The lesions on the shoulder healed promptly, but the arm did not heal until about six months ago, when he was left with a hard cicatrix, which entirely surrounded the left arm at the junction of the upper and middle thirds. This produced so much constriction that œdema of the elbow and forearm developed, which became so pronounced that he was unable to continue his work as a tinsmith. The cicatrix around the arm formed a deep furrow, the circumference of the arm at this point measuring an inch and one-half less than that of the opposite arm at the same level.

On account of the œdema and the uselessness of the arm, its amputation had been advised; but the patient preferred to have an attempt made to relieve the condition by a plastic opera-

tion. Accordingly, on December 14 last, under ether, this cicatricial band was cut away; it extended down to the deep fascia, and by its removal the biceps muscle was exposed. A long flap, consisting of all structures superficial to the muscular plane and extending as far back as the angle of the scapula, was then dissected from the side of the body, and, still attached by its pedicle to a point just external to the nipple, it was brought around so as to cover the denuded area on the upper arm. When first placed in position, it was cool to the touch, excepting at the point where it was still attached to the body; after the application of warmth, however, for twenty-four hours, it regained its normal temperature, and healing by primary union took place. The attachment of the flap to the chest wall was not severed until a month afterwards, during which time the parts were carefully immobilized, and then only partially; ten days later it was completely severed and the inner edge of the flap was sutured in position. The day after the primary operation the œdema of the arm had entirely disappeared, and, since the division of the pedicle of the flap, the patient has gradually regained the use of his arm. He now states that it is as strong as it ever was, and he is again able to work at his trade.

The wound left on the chest wall by the removal of the flap was closed by skin-grafts and healed without any difficulty. The circumference of the arm over the site of the old cicatrix has increased an inch and a quarter since the operation.

CHRONIC LYMPHANGEITIS.

DR. OTTO G. T. KILIANI presented a physician, who, after a chronic infection from chapped hands, while surgical assistant in the hospital, developed enlarged glands in the axilla, which were extirpated. No tubercle bacilli were found in them. Subsequent to this operation, strings of thickened lymphatic ducts were noticed running from the axilla down the arm and side of the chest. They can be plainly felt and seen, and upon the arm they have the appearance of sinews. The condition is gradually improving.

DR. JOSEPH A. BLAKE said the condition presented by Dr. Kiliani's patient was perhaps due to an obstruction of the lymph vessels, secondary to the removal of the lymph glands in the axilla. This enlargement of the vessels may occur not only on the arm, but on the side of the chest as well.

Dr. Blake said that about a year and one-half ago he re-

moved a tumor of the breast, and the patient has since developed an elephantiasis of the arm due to obstruction of the lymph vessels. The operation was not for carcinoma, but for a fibro-adenoma in a rather elderly woman. The condition in the arm is a pure elephantiasis; it resembles a muscular enlargement, and there is no true œdema whatever.

In reply to a question as to whether the theory of an obstruction of the lymph vessels would explain the thickening of their walls, such as was noticeable in Dr. Kiliani's case, Dr. Blake replied that it would not, unless they had become hyperplastic.

DR. L. W. HOTCHKISS said he had a similar case some years ago after removal of the inguinal glands. The operation was followed, after patient's discharge from hospital, by marked œdema of the corresponding leg and side of the vulva. The speaker said he attributed the condition to obstruction of the lymph channels by reason of the removal of these glands in the groin. The case was lost sight of. The speaker said he had never seen a similar case before or since.

DR. KILIANI rejoined that if the condition in his case were due to obstruction of the lymph channels, some œdema would certainly be present. As a matter of fact, there had never been any œdema of the arm. The strings of thickened ducts are quite painful. The speaker said he regarded the condition as a secondary inflammation of the lymph ducts.

ABSCESS OF THE LIVER.

DR. ELLSWORTH ELIOT, JR., read a paper on the above subject. In connection with his paper, Dr. Eliot showed several cases of abscess of the liver upon which he had operated.

DR. CHARLES L. GIBSON said that Dr. Eliot, in discussing the diagnosis of liver abscess, had failed to mention the presence of peptones in the urine. It is true that peptones are found in the urine in several other conditions, but most readily in abscess of the liver. The test is a very delicate one, and should be made by an expert chemist.

In some instances it is difficult to decide whether we have to deal with an abscess of the liver or pulmonary tuberculosis, especially if there is a perihepatitis with involvement of the pleura, and cough; in such cases the use of the aspirating needle may prove very serviceable, and clear up many dubious cases.

In speaking of the treatment of liver abscess, Dr. Eliot referred to excision of the ribs. Certain foreign writers have called attention to the fact that such an extreme measure was usually undesirable and unnecessary when the abscess reached the surface, and Dr. Gibson said that in two cases which had come under his observation simple incision of the abscess and the insertion of a large tube proved all that was needful.

DR. B. F. CURTIS called attention to the fact that some cases of malignant disease gave rise to symptoms which were very deceptive, and which might easily be confounded with those of an inflammatory condition. The speaker said he recently saw a man of sixty, very rugged, who had always led an out-door life, and who was taken suddenly ill about Christmas-time with chills, high temperature, and tenderness in the right epigastrium. It was supposed that he was suffering from some gall-bladder trouble. He improved somewhat and was brought to a town near New York, where Dr. Curtis saw him. His temperature had gone down, but it still ranged from 100° to 101° F., and he complained of chilly sensations. The area of liver dullness was markedly increased downward, the lower margin of the liver being considerably below the free border of the ribs. The leucocytosis was about 12,000. There was some fluid in the belly and tenderness over the entire liver region. The diagnosis was supposed to lie between abscess of the liver and subphrenic abscess. An exploratory incision, however, revealed a carcinoma of the liver, of unknown origin. The fluid in the belly was hæmorrhagic.

DR. KAMMERER referred to a case of cancer of the cæcum in which he did an ileocolostomy. Subsequently, the patient became icteric, which passed off again, and was followed by symptoms of an acute condition of the liver. He suffered from chills and a high temperature which could not be accounted for. The liver was greatly enlarged, its lower margin being fully three inches below the border of the ribs. The organ was punctured over and over again, without discovering any pus. The high temperature continued for perhaps two months, when the man died. The autopsy revealed a diffuse carcinoma of the liver.

DR. GEORGE WOOLSEY said, in reference to the uncertainty of diagnosis, that about two months ago, at Bellevue Hospital, he saw an Italian with a rather vague history, who presented

an enlargement of the liver. He complained of pain in the back and on the right side, not very severe. There was no temperature and but little, if any, jaundice. An exploratory operation revealed that the gall-ducts were normal; but there was an enlarged lymphatic gland in the lesser omentum, which led to the suspicion that there was some trouble, perhaps inflammatory, in the liver itself. Anteriorly the liver felt a little soft on palpation. A full-sized exploring needle was introduced in several places to the depth of the needle, but nothing was found. Nothing further was done, and, when the man left the hospital, his condition was about the same as when he was admitted. Some weeks later, when he saw him in the Presbyterian Hospital, there was marked bulging of the liver, with icterus and a temperature elevation. The patient was subsequently operated on by Dr. Eliot, who found an abscess of the liver in the same region Dr. Woolsey had punctured without discovering pus.

DR. ELIOT, in closing, said that in his cases the urine had not been examined for peptones, as no chemical expert was available at that time. In two of the three cases, the urine contained a small amount of albumen, with hyaline and granular casts, which disappeared shortly after the operation.

Dr. Eliot said his remarks regarding puncturing the liver referred more to the danger of puncturing through the anterior wall. When such a puncture is made and we discover pus, some of it is apt to escape and give rise to trouble. If the symptoms indicate an exploratory operation, we do not gain much by exploring with the needle. By an anterior puncture we may also injure intervening organs, such as the gall-bladder or transverse colon. Some years ago Dr. Bryant reported a case in which such a puncture was followed by fatal hæmorrhage.

Dr. Eliot said the operation which he described differed somewhat from that in vogue in France and Germany. In a recent number of the *Centralblatt* (No. 50, 1900), twelve cases of abscess of the liver are reported by M. Hache (Beyroot), in which the primary operation was done, with two deaths from peritonitis. M. Giordano (Wien) reports seventy-two cases in the past six years where the primary operation was done, with a mortality of 41 per cent. The "primary" operation consists in incision and drainage of the abscess directly after the opening of the peritoneal cavity.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, January 7, 1901.

The President, DE FOREST WILLARD, M.D., in the Chair.

WOUNDS OF THE VENOUS SINUSES OF THE BRAIN.

DR. HENRY R. WHARTON read a paper with the above title, for which see page 81.

DR. OSCAR H. ALLIS said that there was sometimes a difficulty in making diagnosis in head injuries. Some of the injuries would, of course, be sudden, and the symptoms would be masked.

On one occasion he assisted the elder Gross in an autopsy upon a man that had been thrown from a carriage, striking upon the head and profoundly concussed, but without wound of scalp or depression of the skin. Gross said that a surgeon of considerable notoriety had urged very strongly that there should be a trephining of the case. He had watched the case, and refused to trephine it. At the autopsy there was found no topical hæmorrhage or depression of bone, but innumerable little points of hæmorrhages,—the size of a pin-head,—showing that his judgment, that trephining would do no good, was well founded.

Another point: To render the field of operation absolutely sterile, all the hair should be shaven from the head. This he knew to be the practice of Dr. Wharton. A partial shaving of the head leaves an area for contamination that often defeats the best surgical skill. Surgeons are now very generally, in all serious head injuries, demanding that the hair be entirely removed.

He recalled the case of a little child who fell from a piazza, backward, striking her head on an iron rake. The teeth went into the base of the skull. The case proved fatal.

DR. WILLIAM G. PORTER said that there were two things which had impressed him in cases of wound of the longitudinal sinus. One was the enormous amount of gauze which was required in some of them to arrest the hæmorrhage, and, in the second place, the absence of symptoms of cerebral pressure which one would naturally expect to occur from the presence for days of a large amount of gauze tightly packed between the skull and the dura mater. In a recent case of suicidal gunshot wound of the head, during the operation of trephining, the superior longitudinal sinus was opened. The hæmorrhage was frightful, but was speedily checked by gauze packing, and the patient made a good recovery.

DR. WILLIAM L. RODMAN said that he had always been much surprised at the comparative infrequency of these injuries, a fact emphasized by Dr. Wharton in his paper. In an experience of over twenty years, Dr. Rodman had seen but two injuries to the great sinuses of the brain, and he thought that rather remarkable, in view of the frequency with which the cranium is injured, especially in depressed fractures resulting from ordinary trauma, punctured wounds, gunshot wounds, and otherwise.

He fully agreed with the position taken by the essayist, that it will be exceedingly difficult to arrive at an accurate diagnosis in cases not accompanied by fracture of the cranium; for it must be borne in mind that the middle meningeal will suffer much more frequently than the sinuses, and surgeons are therefore apt to trephine on its site rather than on the sinus.

He called attention to the exceeding necessity for acting promptly in cases of this kind, on account of the fact that blood which is lost from the brain always produces a greater amount of constitutional shock and depression than the same amount lost from any other part of the body. Therefore, it becomes not only necessary to control hæmorrhage from the brain with ordinary promptness, but with extraordinary promptness, if it can be done.

He thought that there was very little question that the packing with gauze was the most reliable method of controlling hæmorrhage in these injuries. Of the two injuries of this kind in his personal experience, one was controlled by gauze packing and the other by lateral ligature. He was far better satisfied

with the one treated by packing than the one with lateral ligature. While lateral ligature seems ideally, as does suturing, better than forcipressure, in his judgment they are less so. Forcipressure is more quickly and easily applied, and is more certain in its effect on account of a small opening to work in. Although the essayist had brought out a very good point against the application of forceps, yet, when it is remembered that symptoms of meningitis or encephalitis are unlikely to occur until the third or fourth day, by which time the forceps can be removed with perfect safety, the objection is not so very great. Ligation of cerebral vessels is not perfectly satisfactory: these vessels have no sheaths, and the ligature is apt, on this account, to slip; and he thought one would feel a greater sense of security in using forcipressure next to gauze pressure, which in all instances should be preferred.

DR. G. G. DAVIS said that as regards frequency, he thought in a certain class of cases they are more frequent than the remarks here would appear to indicate. These wounds may occur by puncture. In that case injury to the skull is slight, but they most often occur in extensive fractures of the skull. Therefore, if a person's practice includes many cases of this severe class of injuries, he believed they would be found to be not so very rare. He could not conceive of a laceration of one of these sinuses occurring in cases of concussion, or in other words, without a displacement of the bone. This occurs in those great crashing injuries which break in considerable portions of the skull. This accounts likewise for their fatality. The fatality is not due simply to the hæmorrhage, but rather to direct traumatism to the brain itself.

When it comes to the question of diagnosis, the blood in intracranial hæmorrhage may come from three sources,—from the meningeal arteries, from the large sinuses, and from the vessels of the pia mater. If the question of diagnosis is raised, he should think it would be not as regards that of injury of the sinuses themselves, but as regards some other source of bleeding. Injury to the sinuses would declare itself very quickly, because the blood would come directly to the external opening, the injury being compound. An epidural clot due to hæmorrhage from the sinuses is not likely to occur. He could not conceive of the blood from the sinus dissecting the dura mater away from

the skull. The blood in the venous sinuses would hardly have force enough to do it. If there was an epidural hæmorrhage, the chances would be more in favor of its proceeding from the middle meningeal arteries. The other source of hæmorrhage would be subdural, and a subdural hæmorrhage would occur from concussion, and that, to his mind, with the middle meningeal bleeding, is almost the only hæmorrhage that would give rise to pressure symptoms.

The statistics which Dr. Wharton had quoted from Treves he did not quite understand. If he heard aright, it was 15 per cent. from the large venous sinuses, and 85 per cent. from the middle meningeal artery. Where do the subdural hæmorrhages come in? What part do they play in the question? He thought the statistics from Charles Phelps—it was about 1 per cent.—to be approximately correct.

Of the injuries he had seen to the sinuses, he could definitely recall two,—one of the superior longitudinal in a large crush of the vault of the skull, in which bleeding was controlled by pushing gauze beneath the edge of the skull; another, which he was inclined to think was of the cavernous sinus, but possibly the superior petrosal, or the ophthalmic vein, or some of the vessels closely around the cavernous sinus. The case was one of injury in which a man fell from a height and struck on an iron wheel, rotating as he fell, striking on his forehead. He crushed in the right side of the frontal bone; the orbit was fractured, and there was a very large external wound. In cleaning up, there was a great gush of blood directly from the depths of the wound, which went directly downward and backward towards the posterior portion of the orbit. A large amount of gauze was pushed in, and it controlled the bleeding. It was afterwards removed, and the man recovered. These two cases he could recall definitely, but he believed that he had seen in other cases wounds of the lateral sinus. In these cases there were very severe injuries of the bones.

Dr. Ross related the history of an injury of the superior longitudinal sinus. A woman was brought into the German Hospital on the evening of the Fourth of July, in 1890, unconscious. The history was that she had been sitting on her door-step, when suddenly she fell over unconscious. A careful examination disclosed no cause for the condition. Dr. Deaver saw the case, and

in passing his hand over her head found a lump on the top of her head, in the median line, and on looking he found a bullet. He removed it, packed the wound, and the patient got well. It is probable that the bullet, which had been shot by some person at a distance, went up in the air, and, on coming down, struck her on the head, penetrating her skull.

DR. ALLIS added, with regard to what had been said as to the frequency of cases, that he did not remember a single case coming to the Jefferson Hospital while he was assistant to Dr. Gross, and in his service at the Presbyterian Hospital. He noted that Dr. Wharton and Dr. Porter had referred to cases, but he had never seen one there. The only one he had—sent there from his private practice—was the little child already mentioned who fell on the rake, and struck probably the lateral sinus and at the base of the skull. He thought that this class of cases was comparatively infrequent.

DR. DE FOREST WILLARD said that he had certainly seen in the Presbyterian Hospital one wound of the lateral sinus and two of the superior longitudinal; one, only ten days since, was caused by an enormous fracture; a circumferential fracture, entirely encircling the head, passing through the base of the skull and up the opposite side; the skull being divided into anterior and posterior halves. The longitudinal sinus necessarily was torn through, but there was no marked displacement of the fragments. He trephined in the parietal region, and as he approached the longitudinal sinus the hæmorrhage was simply enormous, but it was speedily and entirely stopped by packing with gauze.

In regard to the effect of hæmorrhage which has been alluded to, his experience had not been that the bleeding was more serious than from other parts of the body. He had been rather inclined to look upon it somewhat as of less importance than from other regions, *i.e.*, that brain cases have borne hæmorrhage well. There are very large venous hæmorrhages, but in the venous sinuses injuries the patient is often in a serious condition apart from the hæmorrhage.

DR. WHARTON remarked that he agreed with Dr. Allis as to the comparative infrequency of wounds of the venous sinuses. He also had been struck with the large amount of gauze packing which it was necessary to use in controlling hæmorrhage from the venous sinuses in certain cases.

He agreed as to the advisability of using suture in suitable cases; but believed that there were very few cases in accidental wounds of the sinuses where a suture could be very satisfactorily employed, and he thought, therefore, that packing was the most generally available method of treatment.

Dr. Rodman had spoken of the comparative infrequency of wounds of the venous sinuses and the importance of prompt action when a large venous sinus was opened. This he appreciated. He did not know of any more alarming form of hæmorrhage than that arising from the superior longitudinal sinus, if the wound is of any extent.

In regard to forceps pressure, it may, in certain cases, be a very satisfactory method of treatment; but the principal objection was the uncontrollable movements of the patient which might cause them to inflict injury upon the brain; so he preferred packing instead of forceps pressure, but the latter may, in certain cases, serve a useful purpose.

In wounds of the lateral sinus made in operations for mastoid abscess, the hæmorrhage is usually not so profuse or serious as in accidental wounds in fractures. The sinuses in these cases are probably more or less thrombosed, and the capacity of the sinus is very much diminished at the point of injury.

As to the suggestion of Dr. Davis that sinus wounds are much more common than are generally supposed, this point he had brought out in the paper; namely, that in cases of extensive injury to the brain where the sinuses were injured, the symptoms of sinus injury were often masked by the grave lesions of the brain. He questioned Treves' statistics as to the frequency of injury to the middle meningeal and great venous sinuses. Treves, of course, makes this statement as regards extradural hæmorrhage. Phelps refers to a great many deaths from pial hæmorrhage. The hæmorrhage in cases of rupture of the pial veins is usually subdural hæmorrhage. Phelps records in 300 cases of traumatism of the brain a great many fatal cases resulting from injury to pial vessels; so that this variety of hæmorrhage is a cause of death, combined with hæmorrhage from the venous sinuses.

TRANSACTIONS OF THE CHICAGO SURGICAL SOCIETY.

Stated Meeting, March 8, 1901.

The President, CHRISTIAN FENGER, M.D., in the Chair.

SPLENECTOMY IN SPLENIC ANÆMIA OR PRIMARY SPLENOMEGALY.

DR. MALCOLM L. HARRIS and DR. MAXIMILIAN HERZOG read a joint paper with the above title, for which see page 111.

DR. MAXIMILIAN HERZOG referred to some of the later views relative to the histology of the spleen that are still disputed. It would appear from the latest contributions, particularly those of Hoyer, Bannwarth, and Kultschitzky, that in the spleen there exist intermediate lymphatic spaces into which the arteries pour the blood, the latter being mixed with lymph and taken up by the veins and carried out. He thought there was some particular object in this arrangement, viz., some parts of the blood which have become old and useless are to be taken up and destroyed. In splenomegaly there was great destruction of blood, as manifested by the blood examination and by the condition of the patient. The changes in the spleens in the two cases of splenomegaly reported were mainly those of an endothelial hyperplasia. In such advanced cases as the case reported by Dr. Sippy, he thought the most prominent changes were somewhat clouded. The changes which are most important were first noted by Gaucher, who in 1882 noticed the extensive endothelial proliferation in primary splenomegaly. Endothelial cells under certain conditions destroyed the red blood-corpuscles. The speaker referred to the experiments of Kupfer, who found that, by transfusing blood from one species of animal into another, the transfused blood-corpuscles were destroyed by the Har cells of the liver. He believed that the destruction of the useless red blood-corpuscles was not brought about directly by the blood-corpuscles being taken up by the endothelial cells, but that certain

splenic cells secrete an enzyme which has erythrolytic properties. He could not find any evidence that the blood-corpuscles were taken up by the endothelial cells, but clinical observation showed great destruction of the blood-corpuscles, so they must be destroyed in some way. If the primary factor in splenomegaly be due to deterioration of the blood, he could hardly see how removal of the spleen would improve the condition of the blood.

DR. BERTRAM W. SIPPY said that, owing to the fact that practically all important pathological changes taking place in the spleen are associated with splenic enlargement, and that an enlarged spleen is accessible to palpation, the attention of the medical profession was attracted at an early date to the study of diseases associated with splenic enlargement. Notwithstanding the great study that has been directed along these lines, there was still much about which very little was known relative to many of the diseases in which splenic enlargement is present. Physicians were well acquainted with a number of conditions in which splenomegaly existed. There was no particular mystery connected with splenic enlargement due to benign and malignant tumors; the degenerative and inflammatory changes that take place in the spleen are not peculiar to that organ. Enlargement of the spleen due to prolonged passive congestion presented no enigma. Physicians had become so familiar with splenic hypertrophy associated with typhoid fever, malaria, syphilis, and other acute infectious diseases, that they scarcely stopped to consider the exact biological significance of it, but were content to use the fact that the spleen was enlarged as an aid in diagnosis. Enlargement of the spleen in amyloid disease, rickets, and tuberculosis was fairly well understood. These forms of splenic enlargement might be termed secondary splenomegaly. They had a plausible etiology, and were, as a rule, passive manifestations of diseases with which they were associated.

There was another class of cases in which, without apparent cause, the spleen was either moderately or enormously enlarged, and unassociated with clinical manifestations other than those of a purely mechanical nature. The removal of the spleen in either of the above conditions would not be indicated unless serious symptoms due to the great size of the organ or twisted pedicle should arise, and even under such circumstances the organ has been held in position by appropriate packing, as carried out by Halsted and others.

A third class of cases were those in which splenic hypertrophy was associated with profound alterations in the blood and general nutrition, a condition leading to cachexia, marasmus, and death. These cases included splenic leukæmia, primary splenomegaly with cirrhosis of the liver, or Banti's disease, and cases such as Dr. Harris had described, to which the terms splenic anæmia, primary splenomegaly, endothelial hyperplasia of the spleen, splenic pseudoleukæmia had been applied by different investigators, the confusion of terms arising from the different theories held by the different men relative to the nature of the disease.

In reference to removal of the spleen in the third class of cases, statistics compiled by Douglas showed that there had been only two recoveries after removal of the spleen in leukæmia, nearly all the cases having died of hæmorrhage soon after or during the operation. Our knowledge of the nature of leukæmia—the disease at times running the course of an acute infection—made it rather improbable that the disorder was due to primary disease of the spleen. A removal of the spleen in leukæmia was not justified. On the other hand, a number of cases, belonging to those first described by Banti in 1894 as primary splenomegaly with cirrhosis of the liver, had been successfully treated by splenectomy. These cases are clinically very similar to the class described by Dr. Harris. Banti believes them to be distinct, however, both clinically and anatomically. He admits that the two affections differ clinically only slightly, but claims that the marked cirrhosis of the liver, which he believes develops in consequence of certain blood changes brought about by the altered activity of the spleen, distinguishes this class of cases from those of the type described by the essayist. If the two diseases were distinct, there had been very few cases of the type described by Dr. Harris that had been treated by splenectomy. Whether splenectomy should be performed in all of these cases would depend upon whether splenomegaly was the primary condition, and upon the results of such operative procedure. It was reasonable to suppose that the two principal features of the disease—splenic enlargement and progressive anæmia—were closely related; either the splenic hypertrophy was due to the anæmia, or the anæmia was due to the splenic hyperplasia, or perhaps both were dependent upon a common and as yet undiscovered cause. Certain

reasons rendered it improbable that the splenic enlargement was secondary to the anæmia. The clinical course of the cases thus far observed made it very probable that the first gross anatomical change occurring in the disease was splenic hyperplasia. There were reasons for believing that the progressive anæmia and other manifestations of the disease might be due to an altered functional activity of the spleen. The results following splenectomy had thus far been gratifying; a decided improvement in the blood and general symptoms seemed to take place within a short time after successful operation. It was doubtful whether a sufficient number of cases had been observed for a long enough period of time after operation to prove the entire success of the procedure. The speaker had at present a case under observation that had shown a marked improvement during the last six months without operation. It was as yet by no means proved that both the splenic enlargement and progressive anæmia were not secondary to a common cause. It seemed rational to believe the splenic hyperplasia in this affection bore about the same relation to the disease as did the enlarged lymph glands to the disease lymphatic pseudoleukæmia.

In reference to pigmentation, the speaker said that in the case now under his observation, pigmentation was associated with leukoderma; the two processes were adjacent and sharply outlined. In Osler's fifteen cases there were seven or eight showing a similar pigmentation, some with, some without, leukoderma. Within the last three months he had seen a case of pernicious anæmia in which pigmentation was likewise associated with leukoderma. The relation of leukoderma and pigmentation to the severe forms of anæmia was worthy of study.

In reference to the histology of the spleen, the picture he had described was similar to that described by some ten others. He believed that only about ten autopsies had been made on such cases previous to his. Possibly the differences occurring in the microscopic picture in the cases reported by Gaucher, Bovaird, Herzog, and Harris, and those usually described, were due to the different age of the process. It was probable that all the cases belonged to the same type of disease.

DR. WILLIAM A. EVANS reported a case observed, diagnosed, and treated by Dr. Clara Ferguson, of Dunning, Illinois. He stated that in Dr. Sippy's case the histology was as follows:

"The majority of the Malpighian corpuscles show only slight alterations. Many appear normal; others present a slight increase in the reticular tissue, and now and then a Malpighian body is found which shows considerable sclerosis. No marked degenerative changes are to be seen in the cells. The veins show a moderate increase. In the connective tissue, which surrounds them, areas are found where the increase is very marked. The reticulum is considerably increased. Now and then are to be found areas of marked sclerosis containing lymphoid cells in the meshes of the fibrous tissue."

DR. A. J. OCHSNER mentioned a case of splenomegaly in a boy, thirteen years of age, upon whom he had operated a year ago last January. The boy was well eight months after the operation, but he thought it doubtful whether the operation would prove of permanent benefit.

He thought the dangers of splenectomy in such cases had been overestimated. In cases of marked leucocythæmia recoveries were few; patients almost invariably died of hæmorrhage. In removing the spleen, if the incision is large enough and the organ is freed before the operator begins to meddle with the vessels, he believed that the operation is very much simplified. The early operations of splenectomy were performed for a hopeless condition, and patients did not die on account of the operation *per se*, but owing to the fact that the operation was done under conditions in which almost any serious operation would prove fatal.

DR. CHRISTIAN FENGER said, if surgeons should not operate on any of the cases of secondary enlarged spleen, then how were they to know on what spleens to operate and those on which not to operate. It would seem to him from what had been said that primary splenomegaly or splenic anæmia was a disease which could be diagnosed and isolated from so-called pseudoleukæmia. Should surgeons operate on every case of this kind? Should they operate for pseudoleukæmia the same as they would for Hodgkin's disease, malignant lymphoma of Billroth, etc.? Is there one form of the disease in which there are enlarged lymphatic glands, and another form in which there is only the enlarged spleen? In cases of leukæmia attended with enlargement of the lymphatic glands and enlarged spleen, with corresponding changes in the medulla, should surgeons operate on

them? Would any surgeon operate on cases of leukæmia in which there were enlarged lymphatic glands? He did not know that any such cases had been operated on for the removal of the spleen. He asked whether we were able to make a diagnosis of primary enlargement of the spleen which was not pseudoleukæmic?

The next question was with reference to early operating. The advice had been given to operate early if the diagnosis could be made. There was one redeeming feature about not operating too early. A great many spleens might be extirpated unnecessarily on account of incorrect diagnoses, and it would take time to progress so far as to make a correct diagnosis of primary splenomegaly. It was not absolutely essential to operate early, as Jonnesco had saved a number of patients by late operations. In four cases of Jonnesco in which there was œdema of the lower extremities, there were three recoveries and one death, by operation; hypertrophic cirrhosis of the liver, three recoveries and one death.

He had seen at autopsies in cases of what were called pseudo-leukæmia exactly similar spindle-shaped or endothelial cells, which were found in the intralobular spaces of the liver and along the bile-ducts where the cirrhosis extended. Was not so-called hypertrophic cirrhosis of the liver the same disease as splenic pseudoleukæmia? Was it not the same as the disease found in the liver, in the kidney, etc.? Then the question arose, Would it help to remove the spleen in such cases? It took time to make a correct diagnosis, and judging from the cases of Jonnesco, which had been saved after having been operated upon late, he would hesitate to operate too early.

DR. DANIEL N. EISENDRATH said it would seem from the points brought out by Dr. Harris, in considering the pathology of this variety of splenic enlargement, that the spleen played the primary part in the diminution of the red blood-corpuscles; and it would seem rational that the removal of the spleen would effect a cure for the disease, as shown in the two cases reported; yet it seemed almost paradoxical that it had been advised in so-called secondary enlargement of the spleen, due to malaria and amyloid disease, not to attack the spleen. In looking over the literature, there were found some recent cases of splenectomy for malarial cachexia (where enlargement is secondary) in which

the results were exceedingly gratifying. Cachexia had existed to a marked degree, and the removal of the spleen caused its disappearance. The patients had gained in flesh, and every symptom due to malarial cachexia had disappeared.

DR. L. L. McARTHUR had had no experience with extirpation of the spleen with the definite diagnosis of non-malignant enlargement of the organ. He had attempted to remove an enormous spleen reaching down into the pelvis, and because of the slipping of the organ from the hands of an assistant after raising it up to ligate its pedicle, a clamp being on, the vessels were torn, and the case terminated fatally. This had made him think that the technique of the operation would not be considered simple, inasmuch as operation was not undertaken when the enlargement was only a relative one. When great enlargement of the organ exists, it was one of the difficult procedures in surgery to safely grasp the pedicle. He had been waiting for three or four years for an opportunity to try an idea which came to him after thinking over this matter in the reduction of the spleen, whether leucocythæmic or not, namely, an attempt to cut off the blood supply of the organ in part by ligating one, two, or three branches of the splenic artery. If we can occasionally bring about reduction in the size of a fibroid tumor or hyperplasia of the uterus by controlling its circulation, it seemed to him feasible, in cases of total removal of the spleen, to induce atrophy of the spleen by a method of that kind. He asked what would be the result of ligation of two or three of the branches of the splenic artery before entering the hilus; whether it would induce an infarct of an aseptic type similar to that shown in one of the spleens exhibited, or whether there would result no more than a simple anæmia of the part in which the circulation had been cut off?

DR. FENGER replied that Jonnesco had solved the question of Dr. McArthur experimentally, there being no particular benefit derived from the ligation of such branches of the splenic artery. There must be left blood supply enough for the spleen, and so far as he knew there were no infarcts described as having taken place in the cases of Jonnesco. Jonnesco had therefore abandoned the procedure.

DR. D. A. K. STEELE said he had never been fortunate enough to recognize the class of cases under discussion definitely enough to make an accurate differential diagnosis from the sec-

ondary form. At present, he had three cases of splenomegaly under his observation, in one of which it would seem that splenectomy was indicated, yet he did not feel certain that it was advisable in a case of primary enlargement of the spleen to remove that organ. As to the other two cases, he felt reasonably certain that they would not be benefited by operative measures.

Regarding the suggestion of Dr. McArthur of ligating two or three branches of the splenic artery for the purpose of reducing the size of the spleen, this had been done experimentally on animals, and he had been informed by Dr. Halsted, of Chicago, that this had been done in six cases in human beings, with four deaths. It was therefore not a more satisfactory or safe procedure than the removal of the entire organ.

DR. MAXIMILIAN HERZOG stated that, from his study of anæmia splenica or primary splenomegaly, he thought it was possible to make a diagnosis of that condition. The clinical picture was a reduction in the number of red blood-corpuscles; reduction of the hæmoglobin, which was beyond the reduction of the number of blood-corpuscles, in other words, a low color index; enlargement of the spleen; no enlargement of the lymphatic glands; only moderate leucocytosis, and no pathological white blood-corpuscles.

As to the other question asked by Dr. Fenger, namely, is not the endothelial proliferation in the liver the same as endothelial proliferation in the spleen? he replied, certainly not. In the body we have epithelial cells with different function. For instance, the epithelial cells covering the skin are different in structure and function from those covering the intestines, etc. Our knowledge of the function of the endothelial cells is still very incomplete. In an organ as different as the spleen is from the liver, the endothelial proliferation in one does not mean the same as endothelial proliferation in the other, because endothelial cells in one organ do not necessarily have the same function as endothelial cells in another organ.

DR. FENGER stated that leucocythæmia was an absolute contraindication against operating. He had removed an enormous tumor from a patient who died from capillary hæmorrhage. Inasmuch as a surgeon should not operate on a patient with a hæmorrhagic diathesis in icterus, so he should not operate on a patient in whom a diagnosis of leucocythæmia had been made.

DR. SIPPY remarked, with reference to the relation of primary splenic anæmia to pseudoleukæmia, that there were those who believed that it was not related to pseudoleukæmia; others believed that it was intimately related to pseudoleukæmia, and the speaker was of the latter opinion. Eichhorst looks upon it as a form of pseudoleukæmia. Stein regards it as a form of pseudoleukæmia, as did Dr. H. C. Wood, who reported the first case in this country, and designated it as splenic pseudoleukæmia. There were reasons for believing that it belonged to the same type of disease as pseudoleukæmia. The clinical course, including blood alterations, was practically the same as that of the ordinary form of pseudoleukæmia, with the exception that in this form of disease the splenic enlargement predominated, while the lymphatic enlargement was slight or might be absent; whereas in the usual form of pseudoleukæmia the enlargement of the lymph glands predominated, while the spleen, if at all enlarged, was usually only moderately so. In practically all of the cases in which post-mortem examinations had been held, a considerable degree of glandular enlargement had been found, showing that the disease had the ear-marks of the ordinary form of pseudoleukæmia. In addition, the foetal or lymphoidal state of bone marrow rather constantly found in this disease is often found in the ordinary form of pseudoleukæmia. For these reasons we were justified in regarding it as probably a form of pseudoleukæmia in which, instead of the lymphatic glands being enlarged, the spleen is enlarged, and along with it moderate lymphatic enlargement, which is only discernible perhaps by post-mortem examination. The disease had a distinct clinical course that could be recognized. It began insidiously; splenic enlargement was the first thing noted by the patient in many cases. In others there would be symptoms of anæmia observed first. The disease was gradually progressive, and no case, so far as the speaker was aware, had recovered without operation. There was some fluctuation in the course of the disease, but in all cases thus far reported without operation, splenic enlargement and anæmia had, on the whole, gradually progressed, cachexia had supervened, ascites, general malnutrition, marasmus, and finally death had ensued.

As to operative procedures, in the five cases collected by him in which recovery had apparently taken place after operation,

two were operated on after grave cachexia had appeared, with marked ascites, extreme anæmia, and great œdema of the lower extremities.

DR. HARRIS, in closing the discussion, expressed the opinion that he had dealt with a distinct disease, so far as Hodgkin's disease was concerned. He did not think there was a specific disease known by the name of Hodgkin's disease. There were probably a number of conditions which go by that name. Recently some studies have been made on the glands of patients who were supposed clinically to have Hodgkin's disease, and they had been found to be a variety of tuberculosis. In these glands they were unable to find the tubercle bacillus, yet inoculations from them produced tuberculosis in animals. The patients presented every clinical evidence of Hodgkin's disease, and a diagnosis was so made. Furthermore, he thought that primary splenomegaly was in no sense similar to malignant lymphoma of Billroth, as it had nothing in common with it. There were no histories of patients having recovered from the latter disease after operation, and of having lived for several months, with constantly improving health, such as the girl he had presented showed. The same blood changes were not found in primary splenomegaly that were found in malignant lymphoma. He was of the opinion that this was a disease in which the primary changes, so far as they could at present be recognized, occurred in the spleen, and that such splenic changes were the direct cause of the anæmia. Concerning the diagnosis, he thought this could be the opinion that this was a disease in which the primary changes, associated with a moderate but persistent anæmia, with a diminished color index, and by the exclusion of other known causes of splenic enlargement.

As to the simplicity of splenectomy, this was only true in certain cases. Splenectomy was not a difficult operation in a case of small spleen, as in a movable or dislocated spleen. Splenectomy for movable spleen, without adhesions, was a comparatively easy operation, but splenectomy for a pathological spleen was not a simple operative procedure. He stated that recently Fricomi had published the mortality statistics for pathological spleens, showing 43 per cent. mortality in about 130 cases. In view of these figures, the operation could not be considered simple. The reason for such a great mortality was that as the dis-

case progresses the spleen becomes much enlarged; adhesions form in the vault of the diaphragm and are difficult to separate; they are hard to get at; hæmorrhage cannot be readily controlled in separating them, and the diaphragm has been lacerated and pleura opened. For those reasons the author recommended that these cases be operated early before the spleen becomes very much enlarged. While he recommended early operation, he distinctly stated that it should be done only after the diagnosis was made and after medicinal treatment had been found to be inefficient. He spoke of the dangers of attempting to clamp the splenic pedicle, which had been alluded to by Dr. McArthur. These veins were thin and fragile. The weight of the clamp on them may tear them, as in the case cited by Dr. McArthur, where the spleen slipped from the hands of an assistant, tearing the veins. In his second case, where he attempted to remove the spleen by clamping in that way, the veins tore at the side of the clamp, and it was with great difficulty that the vessels were again controlled. He recommended always ligating the veins before removing the spleen, to avoid the possibility of tearing them on the side of the clamp.

As to ligating a number of branches of the splenic artery with a view to causing atrophy, in looking over the literature he found that this had been done experimentally and on human beings and proved to be a failure.

ADULT KIDNEY OF FÆTAL TYPE.

DR. L. L. McARTHUR detailed the following case. Through the kindness of Dr. Frankenthal, he was called to see a woman, twenty-five years of age, married. The only factor in her previous history was that since she was fourteen she had frequent symptoms of colic in the right renal region. There was a family history of tuberculosis. She was about the fifth month advanced in pregnancy. There was an oval semi-fluctuating tumor in the right lumbar region. Her temperature fluctuated between 99° and 101° F. By ureteral catheter normal urine was obtained from the left ureter and a few drops of thick pus from the right ureter. The pain and temperature not subsiding, a nephrotomy was done June 27, with the result that 950 cubic centimetres of purulent fluid were evacuated containing a staphylococcus. Drainage was established, and it was deemed advisable to wait

until gestation was completed before thinking of doing anything further to the patient. Normal gestation was completed on November 11. After the lapse of three months, the patient in the mean time making a nice convalescence from her confinement, but having a fistula in the side, from which a considerable quantity of urine escaped, it was a question how to close the fistula or relieve the stricture of the ureter which apparently existed, because fluids could not be injected through the opening into the bladder, and therefore an operation was done which exposed the ureter. The ureter was found of normal size, not dilated, and the conclusion therefore obtained that the obstruction must be somewhere near the pelvis of the kidney. The ureter at its entrance to the pelvis of the kidney penetrated a thickened mass of tissue which felt at least half an inch in thickness at that time, and on introducing a flexible sound into the fistulous opening through the side, it was possible only after long and careful manipulation to make the sound enter the ureter. The ureter was then opened at the junction with the pelvis, the ureteral catheter passed downward to the bladder, and, inasmuch as the pelvis of the kidney was made up of such thickened inflammatory material, not suitable for the lower anastomosis of the ureter with the pelvis of the kidney, it seemed justifiable to remove the kidney, a preliminary determination of the function of the opposite kidney having been previously made. The kidney was removed, and the patient recovered.

The specimen is of interest because of the fact that it presents many characteristics of the persistent foetal kidney. The pelvis of the kidney presents four openings resembling ureters, the normal ureter having entered through the warty-like mass at the point designated.

When it is recalled that this kidney at the time of the first operation held about a litre of fluid, it will be readily seen how a stone, which might have been present in the true pelvis of the kidney, could have been overlooked. The X-ray was thought of in connection with the possibility of stone, and considering the long history of colic since the age of fourteen, it was thought not wise to utilize it during gestation, the tumor lying in too close contact to the pregnant uterus; therefore such a procedure was not utilized; and it proved later that such a procedure would have revealed nothing, as there was no stone found.

In the *Johns Hopkins Hospital Bulletin* for January, 1900, there appeared an article by Max Brödel, in which he calls attention to the anomalies of the kidney of this type, and also to its blood supply. The two important points in his article, and which have some bearing on this case, are that occasionally the kidney presents persistent lobulation, such as obtains in early foetal life, and in some of the lower animals; and, secondly, he has demonstrated by injection methods, and then by the digestion of the soft tissues of the kidney by pepsin and hydrochloric acid, that the vessels of the kidney are not anastomotic vessels, but true end vessels; those which pass along the anterior portion of the kidney do not anastomose to any extent with those that pass behind the pelvis and enter the posterior portion of the kidney, so that we have an area near the convex border that does not contain any of the larger vessels, and gives us a point at which we can make an incision into the kidney with the least fear of hæmorrhage.

TUBERCULOSIS OF THE ILEOCÆCAL VALVE.

DR. McARTHUR also reported the following case. A man, fifty years of age, having enjoyed ordinarily good health, was suddenly seized with a colicky pain, slight elevation of temperature, simulating appendicitis to the family physician and to those who examined him. Upon examination, there was detected a distinct tumor in the neighborhood of the appendix, which was regarded as possibly faecal. When seen by Dr. McArthur, the tumor, which had apparently disappeared, was felt by him low down in the pelvis, and by gentle manipulation was brought up into the abdominal cavity, where it normally belonged. The age of the patient, the absence of any pronounced temperature, and the fact that the tumor could be moved up into the abdomen, led him to make a diagnosis of carcinoma of the ileocæcal region, with the possibility of an appendiceal tumor being the cause. On opening the abdomen, the tumor was found to be in the ileocæcal region, and involving the ileocæcal valve, the ileum, and colon. The appendix was found normal. The outer surface of the tumor was studded with minute miliary tubercles, and led to the probable diagnosis of tuberculosis. Examination of the specimen revealed it to be a case of pure tuberculosis.

The reporter considered the case to be interesting for several

reasons. First, because of the sudden onset of the symptoms. Second, as showing that a stricture of slow formation will give rise to sudden manifestations just when the compensatory hypertrophy, which has taken place in the bowel above, fails to compensate for the obstruction. In other words, in obstruction to the outlet of any organ, as the stomach, the heart, or the bladder, there will be, first, hypertrophy of the muscle; and it does work for a time; but finally the obstruction becomes sufficient to cause dilatation, and then suddenly manifestations of some acute trouble apparently result, when really it is due to an old and chronic trouble. The case was interesting, too, because of the absence of other manifestations of disease, it being proven to be tuberculosis. On investigating the literature of the subject, he had found a most complete *résumé* by Conrath, and among the interesting points noted, primary tuberculosis of the intestine is extremely rare. In 1000 post-mortem examinations on tubercular cadavers (adults) made by Eisenhardt, there was one of primary tuberculosis of the intestine with a question mark. In the literature which has been collected by Conrath, five or six cases of probable primary tuberculosis of the intestine have been found, these having been confirmed by careful post-mortem examinations, with failure to find in other parts of the body tubercular foci to explain it. These cases of primary tuberculosis can only be explained by the ingestion of tuberculous food. Secondary tuberculosis of the intestine is extremely common. About 56 per cent. of all cases of pulmonary tuberculosis develop intestinal secondary tuberculosis. No other manifestations of tuberculosis were noted within the abdomen. The small intestines were not taken out and fingered over, but there was no clinical evidence that there was further trouble. Eighty-five per cent. of the cases of tuberculosis of the intestine that do occur take place in this region. That is a very large proportion of cases. Those who have written most on this subject believe that it is largely due to the fact that at this point a stasis in the intestinal circulation more nearly occurs than at any other point, and the possibility of infection of the mucosa by the erosion of foreign bodies in the intestine could produce a lesion more readily at that point than at other points.

Primary tuberculosis of the stomach has never been observed, so far as the literature reveals.

He called attention in that connection to a point which unfortunately he had learned after having done the operation on this case. After leaving the hospital and reading the *Centralblatt für Chirurgie*, he ran across a suggestion which he deemed extremely satisfactory and desirable, it being given by Bernhard Schmidt, and that is as to the use of the Murphy button in those organs in which the intestine is only partly covered by peritoneum. The suggestion is simple, yet apparently it has never been used. It is this: Where the intestine has been resected, carry the button into the open end, make a puncture, pushing it from within outward, and there will result a perfect fitting of the neck of the button to the intestine with all of the tissues flat, without any need of a puckering-string. This being done on both sides, the two peritoneal surfaces may be brought together. Those who have used the Murphy button in the large intestine and have found difficulty in drawing in the ends by the puckering-string will find that this suggestion is a good one. He recommended its use in gastro-enterostomy after resection of the pylorus, simply introducing the button into the stomach, locating a definite point, making the incision, pushing the button through, making a nice fitting of all layers to the button. In this way a satisfactory anastomosis can be made. His patient was making a good recovery.

DR. CHRISTIAN FENGER stated that primary tuberculosis of the ileocaecal region presented the following characteristics. It formed a tumor-like mass which oftentimes was taken for a neoplasm; it caused stenosis. The prognosis in such cases was good. A number of cases could be found in the literature where extirpation had been successfully done. He asked Dr. McArthur, in regard to the kidney case, how much urine the kidney was secreting, to which Dr. McArthur replied that the urine was not collected, but it secreted enough to make the patient uncomfortably wet all the time.

Dr. Fenger said we could only recognize the value of a kidney from the quantity of urine it secreted, and in order to determine this he has the dressings weighed every time they are applied, and again after their removal. He would not say that the kidney should not have been extirpated in Dr. McArthur's case. In his experience there were quite a number of kidneys that did not appear to secrete much, in which the kidney felt

like a thin-walled sac; yet it was known to possess considerable secreting tissue, and he believed hundreds of such kidneys had been extirpated. When the time for nephrotomy came and the operator did not believe the kidney would secrete very much urine, the organ was found to be valuable so far as the quantity of the secretion was concerned. In one territory of the kidney bright kidney tissue could be found, in another area good kidney tissue, which could not be recognized by the naked eye in all instances; it might be grayish and feel hard, yet it secreted considerably.

DR. DANIEL N. EISENDRATH recalled one case in which Dr. Fenger accomplished an excellent result in operating on the kidney of a medical student where only a thin strip of cortex was left. In a kidney like the one under discussion, the question was not so much how to save it, as to determine what sort of anastomosis can be made with the ureter. What decided that question was the thickness of the pelvis and the impossibility of uniting the ureter to the pelvis, on account of great rigidity and thickness of the latter.

DR. MCARTHUR rejoined that in a paper read by him before the Minneapolis meeting of the Western Surgical and Gynæcological Association he also took the position that no kidney should be extirpated until it had been demonstrated that its functional capacity was of no great value to the patient, and that one would often be deceived in this regard; that a kidney, apparently not more than a mere sac, would, after the dilatation had subsided, on the third or fourth day begin to secrete again.

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INTRAPERITONEAL RUPTURE OF THE BLADDER TREATED BY LAPAROTOMY AND SUTURE.¹

REPORT OF FORTY-FIVE CASES.

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RUPTURE of the bladder fortunately is a rare accident, and the words of Mr. Rivington (*Medical Press and Circular*, February 21, 1883, Vol. i, p. 157) are still true, that "the very rarity of the accident militates against the recovery of patients, for the attainment of personal experience in diagnosis and treatment becomes impossible for the individual surgeon. The recorded experience of many observers combined into one view must remedy this defect." With this object, I present the following remarks based upon the results of my own experience, and a careful study of all the published cases of intraperitoneal rupture of the bladder which have been treated by laparotomy and suture up to the time of writing.

Some confusion has been caused in the past because a sufficiently clear distinction has not been made by many authors between the different forms of rupture of the bladder. To avoid this confusion the following classification may be made: *Classification of Rupture of the Bladder.*

(1) Intraperitoneal traumatic rupture:

(a) Simple.

(b) Complicated, by fracture of pelvis, or other serious abdominal lesions.

¹ Read as a part of the President's address at the meeting of the American Association of Genito-Urinary Surgeons, April 30 and May 1, 1901.

- (2) Intraperitoneal rupture from other causes than trauma:
 - (a) As the result of disease (so-called spontaneous rupture).
 - (b) As the result of accidental injury during surgical operations.
- (3) Extraperitoneal rupture, simple or complicated.
- (4) Combined extra- and intraperitoneal rupture, simple or complicated.

I shall confine my remarks to those cases only of intraperitoneal traumatic rupture of the bladder which have been treated by laparotomy and suture.

It is interesting to glance for a moment at the state of opinion in regard to this accident prior to 1886. Before this time but one case of intraperitoneal rupture is said to have recovered, and the attitude of surgeons is well expressed in the words of Dr. Cusack:

"In accidents of this nature, the surgeon has generally to lament the imperfection of his art while he witnesses the progress of the unfortunate patient to the termination of his sufferings." Or those of Mr. Syme, "if the rupture takes place above, or within, the reflection of the peritoneum, there cannot be the slightest chance of escape."

In an interesting series of articles upon "Rupture of the Bladder," published in the *Lancet* and *Medical Press and Circular*, 1882 and 1883, Mr. Walter Rivington says in closing:

"Entertaining a doubt similar to that expressed by Mr. Willett in 1876, whether a single unequivocal recovery after an intraperitoneal rupture has occurred, I do not in this age of antiseptics absolutely despair of a time arriving when these cases can be successfully treated by surgical means. It has been well said by Mr. Bryant that surgeons have been looking for a satisfactory means of dealing with intraperitoneal rupture of the bladder. Unfortunately, this discovery has not yet been made; neither are surgeons in agreement with each other. Further experience alone can decide between the conflicting views; and

surgery will achieve no unimportant triumph when occasional and indubitable recoveries are insured by improved methods of treatment."

In view of the practice now generally adopted by surgeons in the treatment of this accident, and the results which have followed, it would seem that this "triumph of surgery" had in a measure been attained. It is now the view accepted by all surgeons that immediate laparotomy and suture of the bladder wound affords the only reasonable chance for recovery after intraperitoneal rupture of the bladder.

The idea of this operation is by no means new. Benjamin Bell as early as 1789 proposed to suture the bladder after performing abdominal section in these cases, and Grandchamps, in 1826, proposed the same operation as the result of a series of very interesting experiments upon animals. He showed that the serous and muscular coats of the bladder wounds could be perfectly closed by suture; but that when the sutures were passed through all the coats of the bladder, including the mucosa, leakage occurred, and that this form of suture was nearly always followed by fatal results. He proposed that the operation suggested by Bell should be employed in man in cases of rupture of the bladder. But neither Bell nor Grandchamps seem to have had the opportunity to carry out their views.

The first operation for intraperitoneal rupture of the bladder by laparotomy and suture was performed in 1876 by Mr. Willett, and the description of this case is to be found in the Reports of St. Bartholomew's Hospital, 1876. This case resulted fatally. In 1879, Mr. Heath performed a similar operation with fatal result. Dr. Bull, of New York, in 1885, and Mr. McGill, of Leeds, in 1886, each reports cases with fatal results. It was not until 1886 that MacCormac (*Lancet*, December 11, 1886) published the first two successful cases in a paper in which he describes the technique which has been very generally followed since then. Mr. MacCormac's cases were the first to recover after intraperitoneal rupture of the bladder, with the exception of the case alluded to above, reported by Walters, of Pittsburg, in the *Philadelphia Medical*

and Surgical Reporter, 1861. Ten hours after the accident he opened the peritoneal cavity and removed about a pint of bloody fluid, found an extensive rent at the base of the bladder, inserted a drainage tube into the pelvis and drained the bladder by catheter. He reports a recovery in this case. This case stands as a monument of surgical good luck.

Since the publication of MacCormac's article a number of cases have been reported, and the questions relating to the diagnosis of this injury and the technique of the operation have been discussed. From time to time the cases have been collected and published in the form of tables. The best of these are those by Dr. Kerr (*ANNALS OF SURGERY*, Vol. xvii, 1893) and by Miles (*Transactions of the Royal Medical and Chirurgical Society*, lxxvii, 1895). I find, however, that these tables are imperfect, and do not include all of the cases up to the date of their publication. I have endeavored in the table which I now present to complete the record of cases up to date, and, although I do not know that I have secured a record of every published case, the table is, I think, more complete than any that has heretofore appeared.

I find the reports of forty-five cases of intraperitoneal rupture treated by laparotomy and suture, of these twenty-three died and twenty-two recovered. Therefore, the treatment by laparotomy and suture has been the means of saving one-half of the cases of intraperitoneal rupture which have been reported. But I feel confident that as the result of past experience, and by improvement in operative technique, a still larger reduction will be made in the death-rate from this accident in the future.

Causes of Death.

(1) *Peritoneal Infection.*—If we study the cause of death in the twenty-three cases reported, we find that in four at least, and probably in others, the fatal result was due to imperfect suture of the bladder wound. The first two cases, those of Willett and Heath, treated by this method, died, owing to peritonitis occurring subsequent to the operation as a result

of leakage. These two cases should not really be included in the table. In both the rent in the bladder was closed by suture, which passed through all the coats of the bladder. Had these surgeons at the time been familiar with the experiments of Grandchamps upon animals, they would have known this form of suture is always followed by a fatal result.

In another of the cases, that of Bull, the cause of death is stated as peritonitis due to leakage. In this case nearly two days had elapsed from the time of the injury until the operation, and peritonitis was probably present before the operation was performed.

In two cases the cause of death is stated as shock. The first, that of McGill, was not operated upon until fifty-four hours after the accident, but no peritonitis was present at this time. The other, that of Thorndike, was a case complicated by the tearing away of a large portion of the intestines from the mesentery, requiring an excision of this portion of the bowel and intestinal anastomosis by means of a Murphy button.

In two cases the cause of death was hæmorrhage; in one as the result of the injury, the hæmorrhage coming from the superior vesical vein. In the other the hæmorrhage was secondary to a perineal section made for the purpose of exploring the bladder.

One case is said to have died of pneumonia on the fourth day, and two died on the table before the operation was completed.

In the remaining twelve cases, the cause of death was peritonitis.

It is interesting that in the majority of the fatal cases peritonitis was already present at the time of the operation. And in these, taken together with the four cases in which peritonitis occurred subsequent to the operation, we have a total of sixteen deaths from peritonitis.

The importance, therefore, of an early operation cannot be too much insisted upon. For although we no longer believe the statements made by Gross prior to the advent of surgical

bacteriology, that "all the mischief that can be done is done in the first instance by the escape of urine into the peritoneal cavity, from which it will be out of the power of the surgeon to remove it or to prevent its pernicious effects," nevertheless, the dangers which attend the extravasation of the contents of the bladder into the peritoneum may be very great. Normal urine may come in contact with the peritoneum without causing inflammation, and the table which I present contains cases in which forty, fifty-four, sixty-six, and ninety-nine hours respectively elapsed from the time of the accident and the operation, and yet no signs of peritonitis were present. But, on the other hand, in one case the signs of peritonitis were already present nine hours after the injury.

The peritoneum can dispose of a large number of micro-organisms, but a urine already containing pathogenic organisms is likely to cause peritonitis within a few hours after its introduction. This has been abundantly proved by experiments upon animals and by clinical observation.

Early operation, thorough cleansing of the peritoneal cavity, accurate and efficient closure of the tear in the bladder wall, are the three most important factors in preventing the occurrence of peritonitis after intraperitoneal rupture of the bladder. In this connection it may be stated that in only two of the cases which recovered was there any of the signs of peritonitis present at the time of operation.

(2) *Shock*.—The importance of shock as a factor in causing death after intraperitoneal rupture of the bladder seems to be no greater than it is in many other severe surgical injuries. In only three of the cases reported in the subjoined table was death attributed to shock, and since, without surgical interference, intraperitoneal rupture of the bladder is always fatal, the presence of shock should not deter the surgeon from operating as soon as possible after the accident.

(3) *Hæmorrhage*.—Hæmorrhage does not seem to have been an important factor in the mortality of intraperitoneal rupture of the bladder. Only one case in which death occurred from this cause has been reported.

Fracture of the Pelvis as a Complication.—The occurrence of fracture of the pelvis in cases of intraperitoneal rupture of the bladder is the exception rather than the rule, and this, I think, is an important point of differentiation between cases of intraperitoneal rupture of the bladder and extraperitoneal rupture of the bladder, the fracture of the pelvis being the rule in the latter. The series of cases contained in the accompanying table in only four is it stated that there was fracture of the pelvis, and of these three recovered and only one died.

It seems hardly necessary to discuss the causes of intraperitoneal rupture of the bladder before this Association, since this subject has been so fully covered in the articles by Rivington, MacCormac, and others. It seems to me without question that intraperitoneal rupture of the bladder always occurs as the result of direct violence inflicted upon the lower part of the abdomen, and that distention of the bladder at the time of the accident is necessary. Without distention of the bladder, intraperitoneal rupture does not occur. I believe that in most cases the tear in the bladder wall is due to the forcing backward of the distended viscus against the promontory of the sacrum, although in some cases rupture may occur as the result of *contre-coup*. The arguments which have been advanced (Rivington) against this view are not, I think, convincing.

Drainage of the Peritoneum after Operation.—The question of drainage of the peritoneum after the operation for intraperitoneal rupture of the bladder must be determined by the peculiar conditions in each case. When the operation is performed soon after the injury, and the tear in the bladder has been efficiently closed by suture, and the peritoneal cavity can be thoroughly cleansed, the abdominal wound may sometimes be closed without drainage. Drainage of the peritoneal cavity at least for twenty-four or forty-eight hours does no harm, and offers additional safety to the patient.

In operations where infection of the peritoneum seems probable, and especially if peritonitis is already present, drainage should be used. Drainage by means of plain gauze wicks passed into the pelvic cavity behind the bladder seems to me to be the best at the present time.

Drainage of the Bladder after Operation.—From a study of the forty-five cases contained in the table, it would seem that the drainage of the bladder after operation does not materially affect the mortality statistics. In eighteen cases the bladder was not drained, but the patient was made either at regular intervals to pass his water, or a catheter was introduced every three or four hours. Of these eighteen cases, nine recovered and nine died. In twenty-one cases a catheter was introduced into the bladder through the urethra, and retained there at least during the first few days after the operation. Of these, eleven recovered and ten died. In four cases no statement is made in regard to vesical drainage. In two cases the bladder was drained suprapubically. Both of these latter cases recovered.

It is apparent from the evidence which is afforded by these cases of intraperitoneal rupture of the bladder treated by laparotomy and suture that a successful result in nearly every case depends mainly upon three things: first, surgical intervention at the earliest possible moment after the accident; second, thorough cleansing of the peritoneal cavity; and, third, the perfect closure of the bladder wound by suture. In short, it may be said that the great object of operation is to prevent peritonitis with its accompanying general septic infection. We should ask, therefore, three questions: 1st, How can we prevent delay in operating upon these cases? 2d, How shall we treat the peritoneal cavity to obtain the most thorough asepsis? and, 3d, How shall we most efficiently close the bladder wound? To these questions I desire very briefly to call your attention.

(1) How can we prevent delay? In cases of intraperitoneal rupture of the bladder, every hour saved between the time of the accident and time of operation is of value. I believe that valuable time is often lost after these cases come under observation of the surgeon, and that one of the principal causes of this delay is the methods which are usually employed in order to insure positive diagnosis. When a history of the accident can be obtained, the diagnosis of rupture of the bladder, or at least of a severe intra-abdominal or intrapelvic injury, is not difficult

to make; but valuable time may be wasted by endeavoring to differentiate between an extraperitoneal and an intraperitoneal rupture of the bladder. The injection test to determine the existence of a rupture of the bladder which has usually been employed, or the inflation test which has sometimes been used, as first recommended in 1895 by Mr. Walsham, are tests which not only are unreliable, but are positively harmful to the patient. I desire to emphasize this fact because I once saw an operation delayed more than twelve hours owing to the failure of these tests to establish a rupture of the bladder. During this time the injection test was employed no less than four times, and I believe that the delay in this case was an important factor in causing a fatal termination. I have also seen another case in which no operation was performed on account of the failure of the injection test to demonstrate a rupture of the bladder, and yet the post-mortem examination showed a tear on the posterior wall of the bladder, the patient dying of peritonitis. This case occurred at Bellevue Hospital in the service of a colleague.

The injection test is not only unreliable, it is also likely to spread infection throughout the peritoneum. When used, it should be only after the patient has been prepared for immediate operation and is upon the table. I believe that it is more than probable that it has been a cause of peritonitis in some patients who otherwise would have escaped. An additional objection to this test is that in patients already exhausted and shocked, the pain which it causes is likely to weaken their vitality and lessen their resistance. Of the inflation test I have no personal experience. Mr. Walsham says, as we might expect, that when the intestines are tympanitic it is unreliable. The injection of air into the peritoneal cavity would, I think, be likely to cause in some cases dangerous syncope, and possibly a fatal result. But I do not see the necessity to make an absolutely differential diagnosis between an extra- and an intraperitoneal rupture. Both injuries require immediate operation, and in my opinion both require incision of the abdominal wall. It seems to me to be a simple matter in cases of doubt to begin by exploring the prevesical space through a suprapubic incision,

and if this is found healthy, the incision may be extended upward and the abdominal cavity opened. It seems hardly necessary at the present time to condemn exploration of the bladder through the perineum for purposes of diagnosis or to establish drainage after intraperitoneal rupture.

(2) How shall we treat the peritoneum to obtain the most perfect asepsis? This is a question upon which there is likely to be some differences of opinion, but I believe that the best results can be obtained by the most thorough flushing of the cavity with a hot normal salt solution. This cleansing process should be done not only at the beginning of the operation, immediately after opening the peritoneal cavity, but should be repeated after the rent in the bladder has been sutured.

(3) How can we most effectually close the bladder wound? In the reported cases, various forms of suture have been employed, the preference having been given to the silk Lembert's suture. In the majority of cases only a single row of these sutures has been used. In some cases two rows have been made; and in one case the rent in the bladder was closed by three layers, the mucous membrane being united by fine catgut, and the muscular and peritoneal coat being united by two layers of silk sutures. In two cases the bladder wound was closed by continuous catgut suture. The question is not so much the material of which the suture is made, provided the material will not be absorbed too soon, but the manner in which the suturing is done. In my own case, which is reported in the table, the material used was silk, and the rent in the bladder was closed first by a layer of interrupted Lembert sutures, and these were reinforced by a second layer of crossed mattress sutures.

In some cases when the rent in the bladder extends far down upon the posterior wall, the introduction of sutures is attended with considerable difficulty. Two cases at least have been reported in which the wound was inaccessible and could not be sutured, and Mr. Walsham, in reporting his case, states:

"The suturing of the rent was attended with much difficulty owing to the great depth of its lower limits. No form of

needle-holder was found suitable for introducing Lembert's sutures at this part, though Hagedorn's served the purpose admirably for suturing the upper three-fourths. When those sutures that had been introduced were tied, a clearer view of the lowermost limit of the rent was obtained, and it was then found that quite one-fifth of its entire extent remained unclosed.

"After various attempts, this part was at length secured by means of Smith's rectangular cleft-palate needle. Especial attention is called to this because it is from failure to effectually close the deepest part of the rent that several fatal results have ensued."

In my own case, the details of which are subjoined, the rent in the bladder extended upon the posterior wall deeply into the pelvis. I found Marion Sims's needle-holder a most admirable and convenient instrument, the stitches being introduced by means of a small, full-curved Richard's needle. I mention these details because I believe it is just such small points as these that sometimes prove of inestimable service. I am not in favor of distending the rectum during this procedure; and I believe that all the space necessary for efficiently closing the vesical tear can be obtained by placing the patient in Trendelenburg's posture.

The following history of Case No. 45, Table I, which has not heretofore been reported, is given in detail.

Intraperitoneal Rupture of the Bladder without Fracture of the Pelvis. Abdominal Section and Suture. Recovery.—John B., Englishman, aged twenty-eight years, widower, member of the New York Fire Department, was admitted to Ward 15, Bellevue Hospital, October 27, 1899, with the following history:

At the time of the accident patient was riding on the step of a hose-cart which was being rapidly driven to a fire. The wheel of the cart struck one of the pillars of the elevated railroad and was upset, and the patient was thrown violently forward, striking his abdomen against a hand-rail at the back of the cart. He was unconscious for several minutes after the accident; was brought by ambulance to hospital. On admission he complained of intense pain in the abdomen, which was most severe just above the umbilicus. He had symptoms of shock,

complained of intense desire to urinate, but the retention of urine was complete. He had not passed water for several hours before the accident occurred. Examination by the house surgeon showed the abdomen moderately tense and distended, but not tympanitic. Abdominal muscles rigid. Great tenderness on pressure over the abdomen, especially marked in hypogastrium. A soft rubber catheter, No. 18 F., was introduced without difficulty into the bladder; six ounces of very bloody urine was withdrawn. An attempt to wash the bladder clean with normal sterile salt solution failed; the return from the washing was nearly as bloody as the fluid first withdrawn by catheter. Injection test for rupture with eight ounces of normal salt solution was negative. The same amount of fluid injected was withdrawn. Washing of the bladder and injection test caused the patient severe pain. Four hours later I saw the patient, and upon passing a catheter about an ounce of apparently pure bright blood was withdrawn. He was nauseated, and pain and distention of the abdomen had increased very much since his admission.

Diagnosis of intraperitoneal rupture of the bladder was made, and he was at once prepared for operation. As all the operating rooms in the hospital were occupied at this time, two hours elapsed before he was placed upon the table, so that the operation did not begin until ten hours after the accident.

The Operation.—An incision about two and one-half inches long was made in the median line of the abdomen above the pubis, and through this the prevesical space was opened and explored. It was normal in all respects; a small opening was made in the anterior wall of the bladder between retention sutures; the finger introduced through this opening detected a large, soft blood-clot within the bladder, and upon the posterior wall of the bladder was found a tear which would easily admit three fingers. The abdominal incision was then lengthened upward to within about one inch of the umbilicus, and the peritoneum was opened. On opening the peritoneum a large amount of urine mixed with blood and many blood-clots flowed out. The peritoneum covering the intestines was injected, but there was no peritonitis; all clots and fluid were removed from the peritoneal cavity by sponging and by copious irrigation with hot normal salt solution; the patient was placed in Trendelenburg's position; several coils of the small intestine were drawn

out of the wound and were wrapped in gauze, and during the subsequent steps of the operation were irrigated with hot salt solution; the rent in the bladder could then be clearly seen; it extended for about four inches diagonally across the posterior wall of the bladder from right to left; the rent through the peritoneum was longer than through the muscular or mucous coats. A retention suture was put a little beyond each end of the wound to facilitate the placing of the sutures, the wound in the bladder was closed by a layer of interrupted sutures (Lembert) of fine silk, placed at intervals of about one-eighth of an inch, and passing through the serous and muscular coats of the bladder but not through the mucous membrane (one suture was put in beyond the tear at each end), and by a second layer of mattress sutures. The line of union when all the sutures were placed seemed to be perfect. The peritoneal cavity was now again washed out by large quantities of normal salt solution, the intestines were returned to the abdominal cavity, a drain of twelve small wicks of sterile gauze was passed down behind the bladder to the bottom of the pelvis, the ends of these wicks were brought out through the abdominal wound, which was then closed; the peritoneum by a continuous catgut suture; the muscles by catgut sutures and tension sutures of silkworm gut, the latter included the skin; the edges of the skin wound were united by interrupted sutures of fine silk.

The bladder was drained by a tube passed through the opening in its anterior wall. This opening in the bladder was then closed about the tube by sutures of silkworm gut, the ends of which were also passed through the skin and rectus muscle on each side of the abdominal wound; the wound was dressed with a sterile gauze dressing and drainage of the bladder was established by siphonage. The amount of hæmorrhage during the operation was slight. Few vessels had to be ligated. At the time of the operation there seemed to be no hæmorrhage beyond a slight oozing from the vesical tear.

The operation required about one hour and twenty minutes. The patient reacted well after the operation, his pulse, temperature, and respiration all changed for the better.

The following notes show the progress of the case:

During the night following the operation the patient complained of some pain at the seat of the wound, which was re-

lieved by the administration of seven minims of Magendie's solution hypodermically. He did not vomit, and slept well after twelve o'clock. The drainage of the bladder was perfect throughout the night, except that at 10.45 P.M. a small clot interrupted it for about fifteen minutes. This was easily dissolved by an injection of a small quantity of saline solution through the tube.

On October 28 the patient was very thirsty, and rather restless during most of the morning; vomited once, owing to a mistake having been made in giving him three ounces of milk. He was given calomel at one o'clock, eight doses being administered of one-fourth grain each at half-hour intervals, which resulted in a free catharsis during the evening. The dressings were changed twice during the day, and at six o'clock the patient received peptonized milk and did not vomit.

October 29 most of the gauze drainage was removed from the peritoneum.

November 3 the stitches were removed from the abdominal wound and the drainage wicks were taken out of the peritoneum.

November 8 a small subcutaneous abscess developed at the lower end of the wound; this was opened and drained, and the abscess cavity completely closed three days later.

November 10 drainage tube was removed from the bladder, patient sat up in bed for several hours.

November 11 the following note was made: "There has been no leakage of urine through the suprapubic wound; the patient is able to retain urine for four hours. In the evening a hæmorrhage occurred, apparently from the interior of the bladder, as the result of over-distention, patient losing several ounces of blood. The bladder was washed through the suprapubic wound, and a small drainage tube was inserted into the bladder and retained there for twelve hours. Except for this the patient made an uninterrupted recovery."

After the operation the patient's temperature on two occasions rose to 102° F., due apparently to bronchitis as the result of the anæsthetic. The patient was discharged cured at the end of the fifth week. He has returned to active duty in the New York Fire Department. At this time, eighteen months after the accident, he is perfectly well; urine normal; no urinary symptoms, and the abdominal wound is firm; there is no evidence of a ventral hernia.

EXPLANATION OF TABLE OF CASES.

Table A contains an abstract of all the cases of intraperitoneal rupture of the bladder treated by laparotomy and suture which I have been able to find reported. The list of cases is completed to January 1, 1901. It is probable that some reported cases may have been overlooked, but I have endeavored to make a record as exact as possible. In each case the original report has been read. In preparing this table I have received very valuable assistance from Dr. Geurard and Mr. Brownne, Librarian of the Academy of Medicine.

The table contains the report of nine cases, viz., Nos. 16, 19, 20, 21, 23, 24, 25, 29, and 30, reported before the publication of Dr. Kerr's valuable article, but which are not included in his table; also five cases which are not included by Mr. Miles in his table. Four of these cases—Nos. 23, 24, 25, 29—are omitted from the tables of both Dr. Kerr and Mr. Miles. I have added eleven new cases reported since the publication of Mr. Miles's table.

I have omitted the cases of Walters and Duncan (Nos. 1 and 3, Table B) included in Dr. Kerr's table, and that of Rose (No. 4, Table B), which both Dr. Kerr and Mr. Miles include in their tables, because in these the rent in the bladder was not sutured.

I have included in my table four cases, viz., Nos. 7, 13, 27, and 40, in which the rent in the bladder was both extra- and intraperitoneal. My reason for doing this being that after a careful study of these cases it was apparent to me that the bladder wound in all was principally intraperitoneal.

I have added a second table, Table B, containing the report of six cases of intraperitoneal rupture of the bladder treated by abdominal section in which the rent was not closed by suture.

TABLE OF CASES OF INTRAPERITONEAL RUPTURE OF

A. RENT CLOSED

No.	Reference.	Surgeon.	Age.	Cause.	Date after injury.	Condition of peritoneum.	Size and condition of rent in bladder.
1	St. Bartholomew's Hospital Report, 1876, p. 209.	Willett.	48	Kick.	29 hours.	Peritonitis.	3½ inches; oblique, superior, and posterior; ragged below.
2	Medico-Chirurgical Transactions, 1879, Vol. lxii, p. 335.	Heath.	47	Blow.	42½ hours.	Much blood present.	2 inches; vertical posterior.
3	ANNALS OF SURGERY, 1885, Vol. i, p. 67.	Bull.	46	Fall; fractured pelvis.	13 hours.	Bloody urine.	3¾ inches; posterior.
4	Lancet, London, 1886, Vol. ii, p. 971.	McGill.	54	Ran against iron gate.	66 hours.	Contained a pint of urine; no peritonitis.	4 inches; superior and posterior.
5	Lancet, London, 1886, Vol. ii, p. 1118.	MacCormac.	33	Ran against post.	19 hours.	Healthy; no blood-clots.	4 inches; median, vertical, superior, posterior.
6	Lancet, London, 1886, Vol. ii, p. 1119.	MacCormac.	37	Fell in sitting posture.	27 hours.	Large quantity of urine and serum; no peritonitis.	2 inches; oblique, superior, and posterior, left side.
7	Wiener medicinische Presse, 1886, p. 1225.	Hofmohl.	27	Fall; fracture of pelvis.	10 hours.	Much bloody urine.	1½ centimetres; also extraperitoneal rent 3 centimetres long; ragged edges.
8	Lancet, London, 1887, Vol. i, p. 1133.	Teale.	25	Kick.	.....	Large quantity of straw-colored fluid; no peritonitis.	1 inch; posterior.
9	Lancet, London, 1887, Vol. ii, p. 153.	Holmes.	24	Kick.	6 hours.	No peritonitis.	2 inches.
10	Medical Record, New York, 1887, Vol. xxxii, p. 781.	Keyes.	22	Run over by wagon.	22 hours.	Bloody fluid; no sign of peritonitis.	1½ inches; superior, posterior.

THE BLADDER TREATED BY ABDOMINAL SECTION.

BY SUTURE.

Kind of suture employed.	Treatment of peritoneum.	Incision in perineum.	Catheter in bladder.	Remarks.	Result.
8 silk; one-half inch apart through all coats.	Partially washed out; drainage tube.	No.	Yes.	Peritonitis; lower angle of wound gave way; no injection test.	Death.
Continuous catgut through all coats.	Partially sponged out; drainage tube.	No.	Yes.	Peritonitis; lower angle of wound gave way; no injection test.	Death.
7 Lembert's carbolized silk.	Sponged out; intestines were drawn out of wound and protected by warm moist towels.	No.	Yes.	Died 7 hours after from shock; wound leaked at lower angle; no injection test.	Death.
9 chromic gut; mucous membrane not included.	Washed out with boric acid solution; peritoneum closed, incision in bladder in front of peritoneum for drainage tube.	No.	.....	Died 18 hours after operation, probably of shock; no peritonitis; no injection test.	Death.
16 Lembert, 15 sutures, first and last beyond limit of wound; catgut between; no leakage.	Irrigated with boric acid solution; no sponging; spray; drainage tube four days.	No.	Yes; catheter removed on third day.	No bad symptoms; injection test for leakage.	Recovery.
12 fine silk Lembert's, one above and one below rent; no leakage.	Irrigated with boric acid solution; no drainage tube.	No.	No.	External wound united in a week; injection test for leakage.	Recovery.
Two rows carbolized silk; edges pared when irregular.	Sponged out; extraperitoneal rent only partially closed, to act as drain.	No.	Yes.	Cystitis and urethritis; no injection test for leakage; diagnosis settled by injection.	Recovery.
6 fine catgut Lembert's.	Closed; not stated if washed out; no drain.	Yes, for exploration.	No.	Died 7 hours after of hæmorrhage from perineum; no peritonitis; no injection test, but bladder found tight post-mortem.	Death.
8 fine silk, peritoneal and muscular coats only.	Washed out with warm water.	Yes; median; soft tube in urethra, not in bladder.	No.	Did not drain through tube; no injection test.	Recovery.
9 Lembert's sutures of fine silk.	Flushed out; drainage tube; no leakage of bladder.	No.	No; catheter passed at intervals.	Vomiting continued after operation; collapse set in; patient an old alcoholic; injection test.	Death 18 hours after operation.

TABLE OF CASES OF INTRAPERITONEAL RUPTURE OF THE

No.	Reference.	Surgeon.	Age.	Cause.	Date after injury.	Condition of peritoneum.	Size and condition of rent in bladder.
11	Medical News, Philadelphia, 1887, p. 673.	J. M. Fox.	45	Fell from window.	20 hours.	Bloody urine and bloodclots in cavity; peritonitis.	Transverse tear on upper surface of bladder.
12	Medico-Chirurgical Transactions, 1888, Vol. lxxi, p. 149.	Walsham.	22	Blow.	12 hours.	4 pints blood-stained fluid; no peritonitis.	1½ inches vertical posterior; edges fairly even.
13	Lancet, London, 1888, Vol. i, p. 977.	Symonds.	7	Fall.	7 hours.	Bloody urine.	1¼ inches; Y-shaped; partly intra-, partly extraperitoneal.
14	Archiv Général de Médecine, 1888, Vol. ii, p. 22.	Blum.	28	Run over by wagon.	40 hours.	Quantity of clear yellow fluid; signs of peritonitis.	Size of franc piece.
15	Medical Record, New York, 1888, Vol. xxxiii, p. 632.	Brown.	.....	Fell on corner of doorstep.	22 hours.	Bloody fluid; signs of peritonitis.	1½ inches long; edges ragged.
16	Lancet, London, June 28, 1888.	Halstrom.	21	Not stated.	21 hours.	No details.	1½ inches long.
17	Pittsburg Medical Review, 1888, Vol. ii, p. 55.	Hitchcock.	30	Blow.	.....	Extensive peritonitis.	6 inches long.
18	North American Practitioner, Chicago, 1889, Vol. i, p. 408.	Herrick.	28	Kicked by horse.	23 hours.	Bloody fluid.	.....
19	Indian Medical Gazette, January, 1889, p. 25.	Staunton.	Adult.	Kick.	50 hours.	.....	Extensive tear, posterior wall.
20	Medical Record, New York, 1889, p. 279.	Briddon.	Adult.	.....	Third day.	Signs of peritonitis.	Posterior bladder wall.
21	British Medical Journal, January 26, 1889, p. 191.	Morrison.	25	Distended cystic; bladder gave way.	.....	Signs of peritonitis.	¼-inch rupture of pouch in superior posterior part.
22	New Zealand Medical Journal, 1889-1890, Vol. iii, p. 158.	Knight.	49	Fell against corner of fence.	54 hours.	Fluid escaped; no peritonitis.	1½ inches long; ragged.
23	Wiener medizinische Wochenschrift, 1890, No. 33, p. 1413.	Schramm.	9	Run over by wagon.	50 hours.	Bloody fluid; no peritonitis.	2½ centimetres; superior posterior.

BLADDER TREATED BY ABDOMINAL SECTION.—*Continued.*

Kind of suture employed.	Treatment of peritoneum.	Incision in perineum.	Catheter in bladder.	Remarks.	Result.
15 Lembert sutures.		No.	Yes.		Death 42 hours after operation.
9 China silk Lembert's, one above and one below rent; no leakage.	Irrigated with 1 per cent. boric acid solution till clear; no drain.	No.	Yes; 2 hours only.	No bad symptoms; injection test for leakage.	Recovery.
20 Lembert sutures.	Washed out with carbolic and bichloride solution; peritoneum reopened for irrigation.	No.	Yes.	Died 7 days after; peritonitis; bladder leaked at one spot; no injection test.	Death.
10 fine Lembert's silk, only serum and muscular coats.	Flushed out with boiled water and sponged with carbolic, 1 to 20.	No.	Yes; catheter removed after 48 hours.	After operation vomiting ceased and peritonitis disappeared.	Recovery.
Lembert's sutures.	Irrigated with boiled water.	No.	Yes.	Peritonitis increased; injection test for leakage.	Death 16 hours after operation.
9 Lembert's sutures.	No details.				Recovery.
Lembert's suture.	Irrigated with boric acid solution.	No.	No.	Peritonitis; not stated if injection test was used.	Death.
Lembert's sutures.	Irrigated with boric acid solution; glass drain.	No.	No; catheter passed at intervals.	Peritonitis supervened; injection test for leakage.	Death 49 hours after operation.
Lembert's sutures.				No details.	Death 24 hours after operation.
Lembert's sutures.	Flushed out.	No.	No.	Peritonitis.	Death 14 hours after operation.
Sutures.	Flushed out.			No details, except general peritonitis supervened.	Death 4 days after operation.
Continuous sutures.	Irrigated thoroughly.	No.	Yes; catheter removed on fourth day.	No peritonitis 54 hours after injury; no injection test for leakage.	Recovery.
Lembert's fine silk.	Sponged out; not washed out.	No.	Yes; catheter cleansed daily.	No bad symptoms.	Recovery.

TABLE OF CASES OF INTRAPERITONEAL RUPTURE OF THE

No.	Reference.	Surgeon.	Age.	Cause.	Date after injury.	Condition of peritoneum.	Size and condition of rent in bladder.
24	Deutsche Zeitschrift für Chirurgie (reported by Rose), 1890, No. 31, p. 366.	Mikulicz.	28	Stones fell on abdomen; fracture of pelvis.	11 hours.	.....	10 centimetres.
25	Lancet, London, 1892, Vol. i, p. 306.	Lloyd.	30	Thrown from wagon and companion fell across patient's abdomen.	28 hours.	Signs of peritonitis.	2 inches; stellate superior posterior.
26	Lancet, London, 1892, Vol. ii, p. 197.	Hulke.	33	Butted in abdomen.	72 hours.	Bloody gum-mous fluid; extensive peritonitis.	2½ inches long; posterior wall.
27	Archiv für klinische Chirurgie, Band xliii, Heft 2.	Schlange.	34	Run over by wagon.	24 hours.	Bloody fluid; no peritonitis.	Intra- and extra-peritoneal rent.
28	Lancet, February 6, 1892, Vol. i.	Page.	.....	Man fell across abdomen.	28 hours.	Acute peritonitis.	Stellate wound on back wall and upper part of fundus.
29	Lancet, London, 1892, Vol. i, p. 867.	Lane.	37	Run over by wagon; fracture of pelvis.	4 hours.	Some bloody fluid; intestines much bruised; no peritonitis.	1½ inches; transverse superior.
30	Lancet, London, 1893, Vol. i, p. 413.	Marsh.	34, female.	Kicked in abdomen.	80 hours.	5 or 6 pints of bloody fluid; signs of peritonitis.	2½ inches behind and below fundus; ragged.
31	ANNALS OF SURGERY, 1893, p. 653.	Pilcher.	23	Fell from second story of house.	12 hours.	Intraperitoneal hæmorrhage; no peritonitis.	1½ inches long; longitudinal rent.
32	ANNALS OF SURGERY, 1893, p. 647.	Kerr.	23	Fall 33 feet; fracture of pelvis.	8 hours.	Bloody fluid; no peritonitis.	Combined intra- and extraperitoneal rupture.
33	Lancet, London, 1894, Vol. ii, p. 1032.	Murphy.	24	Run over by horse.	2 hours.	40 ounces fluid removed; no peritonitis.	Vertical rent from apex to trigone.
34	Medico - Chirurgical Transactions, 1895, Vol. xxviii, p. 275.	Walsham.	38	Man fell across patient's abdomen.	25 hours.	Blood - stained fluid; no signs of peritonitis.	2½ inches; vertical from apex to trigone; slightly ragged.

BLADDER TREATED BY ABDOMINAL SECTION.—*Continued.*

Kind of suture employed.	Treatment of peritoneum.	Incision in perineum.	Catheter in bladder.	Remarks.	Result.
Three-fold sutures; catgut in mucosa, silk in muscular, and continued catgut in serum coats.	Washed out with salicylic acid solution; drainage tube.	No.	Yes.	.....	Recovery.
Lembert's sutures; catgut.	Flushed out with boric acid solution.	No.	No.	Patient died before operation was completed; peritonitis.	Death.
Double row of sutures.	Flushed out.	No.	No; catheter passed at intervals.	Vomiting returned after operation; peritonitis continued; injection test for leakage.	Death 4 days after injury.
Lembert's sutures to intraperitoneal rent.	Sponged out, not flushed out; extraperitoneal wound packed with iodoform gauze.	No.	No; catheter passed at intervals.	.....	Recovery.
Lembert's sutures.	Flushed with boric acid solution.	No.	No.	.....	Died on table.
Continuous sutures.	Sponged out, not irrigated.	No.	Yes.	4 days later patient attacked by pneumonia; no injection test.	Death.
20 fine silk Lembert's sutures.	Flushed out.	No.	No; catheter passed at intervals.	Vomiting set in, and patient sank gradually; general peritonitis; injection test for leakage.	Death 21 hours after operation.
Lembert's sutures.	Flushed and sponged out thoroughly.	No.	No.	Hæmorrhage from torn superior vesical veins; no injection test.	Death 2 hours after operation from shock and anæmia.
Side of bladder sutured to pubes.	Pelvis tamponed with iodoform gauze; bladder and Retzius space drained.	No.	No.	Drain-tube removed after firm adhesions had formed.	Recovery.
15 catgut sutures to muscular coat only.	Washed out; glass drain-tube.	No.	Yes; catheter removed on eighth day.	No injection test for leakage; diagnosis settled by injection of boric acid solution.	Recovered.
14 fine silk Lembert's sutures.	Flushed out thoroughly with 1 to 3000 hyd. perchloride and then with 2 per cent. boric acid solution.	No.	No; catheter passed at intervals.	Diagnosis settled by inflation of bladder with air, when liver dullness disappeared; injection test for leakage.	Recovery.

TABLE OF CASES OF INTRAPERITONEAL RUPTURE OF THE

No.	Reference.	Surgeon.	Age.	Cause.	Date after injury.	Condition of peritoneum.	Size and condition of rent in bladder.
35	Deutsche medicinische Wochenschrift, 1896, Vol. xxii, p. 9.	Cramer.	49	Fell down stairs.	30 hours.	No peritonitis.	5½ centimetres long; transverse posterior.
36	Münchener medicinische Wochenschrift, 1896, Vol. xliii, p. 72.	Degen.	31	Fell down stairs.	24 hours.	Bloody fluid; no peritonitis.	4 centimetres long; posterior; edges rather smooth.
37	Lancet, London, 1896, Vol. i, p. 991.	Heaton.	28, female.	Fell across patient's abdomen.	15 hours.	Bloody fluid; no peritonitis.	3½ inches; superior posterior; ragged.
38	Australian Medical Gazette, 1896, Vol. xv, p. 462.	Ryan.	23	Blow.	17 hours.	Bloody fluid; no peritonitis.	4 inches rectangular; superior and posterior; ragged.
39	British Medical Journal, 1897, Vol. i, p. 1282.	Percival.	35	Kick.	9 hours.	Blood-clots and urine; signs of peritonitis.	4 inches; median posterior.
40	ANNALS OF SURGERY, 1898, Vol. xxviii, p. 385.	Ashhurst.	.....	Fall.	.....	Bloody fluid, signs of peritonitis.	Large, irregular extra- and intra-peritoneal rupture.
41	Lancet, London, 1898, Vol. ii, p. 868.	Littlewood.	28	Fall.	12 hours.	Bloody fluid; slight peritonitis.	1½ inches; superior posterior.
42	Journal of Cutaneous and Genito-Urinary Diseases, May, 1899, p. 210, et seq.	Thorndike.	32	Fall.	24 hours.	Rupture of bladder and 10 inches of bowel torn from mesentery.	Large rent in fundus and posterior wall.
43	Northwestern Lancet, 1899, Vol. xix, p. 134.	Engstad.	.....	Fell from wagon, striking upon the wheel.	Not stated, but about 15 or 20 hours.	Bloody urine; subperitoneal tissue infiltrated; no peritonitis.	Tear ½ inch upon summit of bladder, 1½ inches upon anterior wall.
44	British Medical Journal, 1900, Vol. ii, p. 1772.	Bloomer.	35	Fall on curbstone.	90 hours.	Bloody fluid; no peritonitis.	Tear in posterior wall admitting 2 fingers; tear in peritoneum 1 inch longer.
45	British Medical Journal, 1900.	Alexander.	28	Blow on lower part of abdomen.	10 hours.	Full of blood-clots and urine; no peritonitis.	Rent 3½ inches on posterior wall diagonal from right to left.

BLADDER TREATED BY ABDOMINAL SECTION.—*Continued.*

Kind of suture employed.	Treatment of peritoneum.	Incision in perineum.	Catheter in bladder.	Remarks.	Result.
Lembert's suture of catgut.	Sponged out, not flushed out; no drain.	No.	No.	Injection test for leakage.	Recovery.
Lembert's sutures of fine silk.	Sponged out, not flushed out.	No.	No; catheter passed for first 2 days at intervals.	Patient had cystitis and pneumonia, and on seventh day suture gave way, and yet recovered after 2 months' treatment.	Recovery.
Fine Chinese-silk sutures; double row of Jobert and Lembert's, 20 to 30 in all.	Irrigated and sponged out; no drainage tube.	No.	Yes.	Voluntary power of passing urine did not return for some time.	Recovery.
Continuous sutures of chromicized catgut.	Irrigated with boric acid solution; drainage tube through perineum.	No.	No.	Perineal tube removed on sixteenth day; injection test for leakage.	Recovery.
10 Lembert's silk suture, 30 or more in addition.	Irrigated; no drain-tube.	No.	Yes.	General peritonitis; death attributed to omission of drainage tube; injection test for leakage.	Death.
Lembert's sutures of silk.	Irrigated with salt solution; drain-tube through wound.	No.	Yes.	General peritonitis supervened; injection test for leakage.	Death after 3 days.
Lembert's sutures.	Sponged out; drain-tube in pelvis.	No.	No.	Passed urine spontaneously in 6 hours; injection test.	Recovery.
Lembert's sutures.	Murphy button in bowel; gauze drainage.	No.	Yes.	No leak in rent up to death.	Death from shock on fourth day.
Czerny-Lembert sutures; silk.	Cavity cleaned; gauze drain.	.....	Yes, for 10 days.	.....	Recovery.
Closed with continuous sutures.	Flushed with boric acid solution; drained with Keith tube for 48 hours.	.....	Yes.	Sinus for 2 months.	Recovery.
Double row of silk Lembert and mattress sutures, interrupted.	Irrigated and drained by gauze wicks, surrounded by gauze funnel passed into post-vesical pouch.	No.	Suprapubic double-tube through opening made in prevesical space.	Injection test for diagnosis negative; no fracture of pelvis.	Recovery.

TABLE OF CASES OF INTRAPERITONEAL RUPTURE OF THE

B. RENT NOT

No.	Reference.	Surgeon.	Age.	Cause.	Date after injury.	Condition of peritoneum.	Size and condition of rent in bladder.
1	Philadelphia Medical and Surgical Reporter, 1861.	Walters.	26	.....	10 hours.	Bloody fluid; peritonitis.	Extensive rent at base.
2	Centralblatt für Chirurgie, 1885, p. 838.	Sonnenburg.	.....	Fall.	48 hours.	Peritonitis.	Vertex to neck, posterior.
3	Lancet, London, 1886, Vol. ii, p. 399.	Duncan.	38	Run over by wagon.	22 hours.	Bloody fluid; peritonitis.	2½ inches posterior.
4	Deutsche Zeitschrift für Chirurgie, 1890-91, No. 31, p. 358.	Rose.	7	Run over by wagon; fracture of pelvis.	48 hours.	Commencing peritonitis.	Stellate rent on upper surface 3-4 centimetres.
5	Lancet, London, August 4, 1888, p. 208.	Brown.	20	Horse fell on patient.	11 hours.	.....	Rent posterior wall far forward.
6	Glasgow Medical Journal, Vol. xlix, p. 370, 1898.	Dalziel.	.....	Fall.	.....	Bloody fluid; no peritonitis.	Tear involved prostate and peritoneum.

BLADDER TREATED BY ABDOMINAL SECTION.—*Concluded.*

CLOSED BY SUTURE.

Kind of suture employed.	Treatment of peritoneum.	Incision in perineum.	Catheter in bladder.	Remarks.	Result.
No sutures.	Clots sponged out; drainage tube.	No.	Yes.	.....	Recovery.
No sutures.	Drainage tube through upper part of abdominal wound.	No.	No.	Intense peritonitis and urinary infiltration.	Death on fourth day.
No sutures.	Washed out; glass tube in Douglas's pouch.	Yes; tube passed through incision.	No.	Died 79 hours after suppression of urine; kidney trouble the result of stricture.	Death.
No sutures.	Abdominal cavity flushed out; bladder drained through abdominal wound and packed with iodoform gauze.	No.	No.	Abdominal drain removed as soon as adhesion had shut off abdominal cavity.	Recovery.
Wound inaccessible to suture.	Abdominal cavity irrigated; drain-tube.	No.	Yes.	.....	Death 11 hours after operation.
Bladder sutures to skin.	Bladder packed with aseptic gauze to control hæmorrhage; drain-tube in pelvis in front of bladder.	Yes.	No.	4 days later stitches fixing bladder to skin were removed; wound closed and healed in 3 weeks.	Recovery.

STRANGULATION OF THE TESTIS BY TORSION OF THE CORD.

A REVIEW OF ALL RECORDED CASES, TOGETHER WITH THE
REPORT OF ONE RECENT CASE.

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THERE is evidence at hand that nearly every viscus of abdominal origin is liable to rotate axially and twist its pedicle. The spleen, the ovary, the gravid uterus, the kidney, and the testicle have all suffered twists of their pedicles. It is well known that tumors such as ovarian cysts, dilated tubes, uterine myomata, omental hydatids are likewise liable to rotation.

The undescended testicle is an extremely interesting organ. The likelihood of sarcomata developing in it is great. If the deformity is bilateral, sterility is suggested. Atrophy is probable in any event. Its pedicle or cord is liable to become twisted and gangrene result.

In order that the discussion of the cause of rotation of the testicle may be understood, it is necessary to state a few facts regarding the anatomy of the mesorchium.

The urogenital fold lying in the abdomen on the dorsum reaches to the tail end of the embryo. The greater part of this fold becomes the Wolffian body. Towards the head end this fold contains the testis and epididymis. The part of the fold tailward of the testis contains the vas deferens. The part of the fold dorsal to the testis and epididymis acts as a suspensory membrane (mesorchium) comparable to a mesentery, but it is quite thick. In through the mesorchium proceed the nutrient

vessels of the testis and epididymis. The embryonic mesorchium disappears if the testis develops normally.

The part which corresponds to the mesorchium in the adult normal testicle is the space uncovered of tunica vaginalis where the vessels enter the testicle and the epididymis. Having identified the mesorchium, the explanations of how it is possible for the testicle to become twisted will be much more intelligible.

A more or less incomplete fixation of the testicle is seen in almost all anomalies of its development, and in all disturbances of its descent (Bramann, *Archiv für klinische Chirurgie*, Band xl, pp. 137-166).

The absence of the mesorchium in these cases of torsion of the cord spoken of by Nicoladoni is a misnomer, for in reality the mesorchium is lengthened. This lengthening is explained in some cases as follows: There is a tardy descent of the testicle; the processus vaginalis develops normally. When the testicle finally descends, there is a wide and large cavity formed by the processus vaginalis, into which the testicle hangs, and, as it grows, drags down the cord until by the time it reaches the bottom of the sac there is a long mesorchium.

In all recorded cases of torsion of the cord operated upon, a deformity, or a delay in development, or some abnormal condition about the testis, has been found. In all cases the testicle has been discovered to be freely movable within the tunica vaginalis. In some instances the epididymis and testicle have been considerably separated from each other. In not a few the cavity of the tunica vaginalis was larger than usual, extending well up the cord. In 47 per cent. of all cases the testicle involved was undescended, lying within the inguinal canal, or but partially descended, lying close to the external abdominal ring. In every case there was a long mesorchium. A flattened appearance of the testicle existed in a few cases. How the twist occurs is unexplained, except theoretically.

A testis properly placed in the scrotum and normal in every particular cannot be easily twisted. The anatomical findings in these reported cases suggest very strongly that the

long mesorchium permits torsion. What makes the testis twist in each instance is yet undemonstrated. With the long mesorchium the testis can be twisted on its cord easily. Without the long mesorchium the cord cannot be twisted. The symptoms are in proportion to the degree of the twist.

Sutton reports a case in a dog of retained testis, the seat of a tumor. At autopsy it was discovered that the tumor had been twisted on its cord, and that there was great congestion of the mass in consequence.

Kocher called attention to the bifurcation of the cord as one of the causative factors of torsion. It is true that in many of these cases the undeveloped mesorchium gives the appearance of a double cord inserted at the two poles of the horizontally placed organ. This observation may have some value.

Lauenstein, Schmidt, and others think that the flattened shape of most ectopic testicles and of most cords of such testicles contributes something to the ease of torsion; that the anterior abdominal muscles assist in twisting the testicle, as they relax and contract.

English, of Vienna, thinks that a primary thrombosis of the veins of the pampiniform plexus exists, and that the torsion of the cord is only a part of the whole process. Thus it appears that the etiology of torsion of the spermatic cord is still undetermined. Certain very definite anatomical conditions are known to exist in these cases, but how the twist is produced is unknown.

Granting that from some peculiarity in development the testicle can easily be twisted upon its cord, it is conceivable that a slight trauma may cause the twist. The cases recorded by Helferich, Mikulicz, Czerny, and Nicoladoni exerted themselves violently immediately preceding the sudden initial symptoms.

The first observation of torsion of the spermatic cord with resulting gangrene in man was associated with an error of diagnosis.

Delasiauve, in 1840, related the case now reported under his name. This case was mistaken by the attending physicians

for one of strangulated inguinal hernia; a gangrenous testicle was discovered, orchidectomy was done, and the man recovered.

Since this first recorded instance of strangulation of the testis by torsion or twisting of the spermatic cord in 1840, thirty-one well-authenticated cases have been reported in medical literature. The case reported in the present communication makes a total of but thirty-two cases.

The effect of torsion of the cord upon the testicle has been recognized for many years in animals. Indeed, torsion is an ancient method of producing atrophy of the testis in horses and rams.

It has been known that a testicle might atrophy after an operation for varicocele; and in 1832 Delpech was killed by a patient upon whom he had performed a bilateral operation for varicocele which had been followed by atrophy of both testicles.

Scarenzio, Maas, and Niemann report instances of what they designated as periorchitis, in which within the tunica vaginalis no pus was found, but a quantity of hæmorrhagic fluid and a testicle swollen and of a blackish-blue color.

Volkman, in 1877, reported a case of spontaneous gangrene of the testicle with acute hæmorrhagic infarction. No twist of the cord was evident in this case. English reports a similar case. Volkman found a gangrene of the testicle in a case of varicocele in which he had resected for some distance the varicose veins of the cord.

These cases so interested Volkman that he urged Miflet to report certain researches upon the effect upon the testis of ligating the different vessels of the cord in dogs.

The conclusions warranted from these experiments are

(1) The spermatic artery has the importance of a terminal artery for the testicle.

(2) The obliteration of the spermatic artery by ligature or embolus is rapidly followed by the formation of a hæmorrhagic infarction. These infarctions occupy the superficial layers of the gland.

(3) The tissue of the testicle is apparently very sensitive to disturbances of the circulation in the cord vessels, not only when the circulation is interrupted in the spermatic artery and veins, but also when the veins alone are obliterated. There is always a degeneration of the testicle which is accompanied by more or less proliferation of connective tissue.

(4) The epididymis which is supplied by the deferential artery does not show any changes when the spermatic artery is tied or plugged by embolus.

(5) If the circulation is stopped in both the spermatic and deferential arteries, the tissues of the epididymis then show degeneration.

The testicle in cases of torsion of the cord is found swollen, dark blue to black in color; the cord is twisted from right to left or from left to right. Parenchymatous hæmorrhage into the testicle or gangrene is present. The vaginal process contains blood-clot and serum. Section of the testicle shows either hæmorrhagic infarction, or that no organ is left, or that interlobular hæmorrhage has occurred.

The cases of torsion of the cord that have been recorded may for convenience be grouped into those not operated upon and those operated upon.

Of the unoperated cases there are two classes: first, that in which the twist of the cord was simply untwisted (see the case reported by Nash, No. 17); second, that in which there were recurrent twists and relief was repeatedly secured by untwisting the cord (see the case reported by Van der Poel, No. 23). Of those operated upon there are likewise two groups: first, that in which the testicle was not primarily removed (atrophy and gangrene followed in these cases. See the cases reported by Bryant, No. 11, and by Davies Colley, No. 13); second, that in which orchidectomy was done immediately. This last group is, of course, the largest. (See the case reported by Scudder, No. 29.)

Especial interest is excited in these cases of torsion of the spermatic cord because the onset of the symptoms is so very sudden. A severe sudden pain in the testicle, nausea, vomiting,

a slight elevation of temperature, a tumor in the groin or scrotum, which is or soon becomes inflamed, a moderate degree of shock, a chill. These are the usual signs of torsion of the spermatic cord.

It is extremely difficult to distinguish at times between strangulation or incarceration of the bowel and strangulation of the testis. If the external abdominal ring is empty and an imperfectly descended testicle is present, the mistake can hardly be made.

The constitutional disturbance associated with a strangulation of the bowel is far greater than that witnessed in strangulation of the testis.

Obstruction of the bowel is ordinarily absent in cases of torsion of the cord.

If a hernia is present on the same side as the twisted cord, it will be difficult to distinguish between strangulation of this hernia and torsion of the spermatic cord. Torsion of the spermatic cord and strangulation of the testicle have been mistaken for periorchitis, rupture of a varicocele, and strangulated hernia.

Seventy-five per cent. of all the cases of strangulation of the testicle were under twenty-four years of age; from birth to four years of age were four cases; from thirteen years to twenty-three years were twenty cases; from thirty-three years to thirty-eight years were three cases; from forty-one years to forty-nine years were two cases; from sixty years to sixty-two years were two cases. In one case the age was not mentioned, making the total of thirty-two cases.

In 47 per cent. of all the cases the organ involved was an undescended testicle; that is, fifteen of the thirty-two cases presented undescended testicles. This is not a mere coincidence. The fact that the cords of so many undescended testicles have become twisted strongly endorses the view mentioned in discussing causes, namely, that the embryological character of the undescended testicle is an important etiological factor.

In 16 per cent. of the cases a hernia was present upon the same side as the torsion of the cord.

In 88 per cent. of all cases the testicle became gangrenous.

In twenty-five of the thirty-two cases primary orchidectomy was done for gangrene of the testis.

In seven of the cases no operation was done.

Sloughing of the testis occurred subsequently in three cases. Atrophy was noted later in two cases, and in two, which were untwisted, no subsequent history is given regarding atrophy.

All of the thirty-two cases recovered. There was no mortality. The testicle in each case sloughed or atrophied.

If perchance a case is seen immediately after the onset of pain and the diagnosis is positive, untwisting the twist in the cord may be tried. If the case is seen later than an hour after the acute onset, orchidectomy is indicated.

The following list of cases includes all recorded genuine instances of torsion of the spermatic cord.

RECORDED CASES OF TORSION OF THE SPERMATIC CORD.

(1) DELASIAUVE (*Revue méd. franç. et étrang.*, 1840, p. 363). Symptoms were present suggesting strangulated hernia. Repeated taxis had been tried previous to operation.

Operation.—Orchidectomy. The cord was twisted; the testis was gangrenous.

(2) SCURENZIO (*Annali universali di medicina di Milano*, 1859, p. 600). Aged forty-one years; for four days acute pain in groin with swelling and peritoneal symptoms. Examination after four days, a tumor along the inguinal canal and the testicle at the external ring. Thought to be a strangulated hernia.

Operation.—Serous fluid in tunica vaginalis, testicle enlarged and violet in color. Cord twisted twice upon itself. The testicle showing fluctuation was incised, but no fluid came away. Orchidectomy. Testicle found full of blood-clots. Recovery.

(3) LANGLET (*Société Anatomique*, 1871, p. 281). Man, aged twenty-one years. Gave history of right testicle occasionally ascending after remaining long in sitting posture. Testicle was always easily replaced, however; finally, the ascended testicle, without apparent cause, became strangulated, leading to pain, swelling, and nausea.

Operation.—Four days after the onset of symptoms. Testicle found in diverticulum beneath the skin of abdomen twisted one-half turn from right to left, and from below upward. The cord was very short, and when the testicle was untwisted it was still inverted, i.e., the epididymis was in front and above. Attempt made to save testicle, but it became gangrenous, and was finally removed. Recovery.

(4) NICOLADONI (Langenbeck's Archiv für klinische Chirurgie, Band xxxi, Heft 1, 1885). A boy, sixteen years old; undescended right testicle, sudden sharp pain, swelling in external ring. Sac contained small amount of bloody, serous fluid and discolored testicle; cord twisted from right to left. Orchidectomy. Veins occluded; arteries partly patent.

(5) LANGTON (St. Bartholomew's Hospital Reports, Vol. xvii, 1888, p. 188). Man, thirty-three years old, without history of an injury, presented a swelling the size of an orange in the left side of the scrotum; the skin of the scrotum was slightly œdematous. The cord appeared normal above the swelling. The enlargement appeared suddenly. The sac of the tunica vaginalis was aspirated and bloody fluid evacuated; later it was incised and blood-clots evacuated. The testis and epididymis were enlarged and black in color; the epididymis was twisted. It was impossible to untwist it. Later, the testicle and epididymis sloughed away through the wound; the wound then healed.

(6) NICOLADONI (Langenbeck's Archiv für klinische Chirurgie, 1890, p. 163). Man, sixty-two years old. After heavy work had pain in right side of scrotum and vomiting. Redness, œdema, and fluctuation were present. Incision tunica 200 grammes hæmorrhagic fluid. Enlarged testis, dark cherry color, hung on a double pedicle. Orchidectomy, recovery.

(7) FRITZ COHEN (Deutsche Zeitschrift für Chirurgie, Band xxx, 1890, p. 101). Man, twenty-one years old. The right testicle lay in the inguinal canal. He was thought to have a strangulated hernia. Three days before sudden sharp pain in the right groin. A tense, elastic tumor was felt at the seat of pain.

Operation.—Sac opened, muddy red fluid evacuated and a swollen, black testis discovered. The cord was twisted. Orchidectomy. Recovery. Hæmorrhagic infarction of the entire testis with necrosis in the peripheral portions.

(8) WHIPPLE-NASH (British Medical Journal, June 6, 1891, p. 1226). Boy, aged sixteen years; undescended left testis. Strained himself. Felt something give way in groin. A lump appeared in the groin, and the following morning he vomited. Diagnosis made of a strangulated hernia.

Examination.—Hour-glass swelling of scrotum and groin. Lower half of swelling is testis. Upper half size of a hen's egg, tense, dull on percussion, no impulse when coughing. Orchidectomy. The upper half of sac contained bloody fluid. Epididymis was strangulated, testis below. Cord and epididymis twisted twice.

(9) CZERNY-MEYER (Deutsche medicinische Wochenschrift, 1891, No. 25, p. 800). Aged eighteen years; upon sneezing was seized suddenly by severe pain in right testicle, vomited twice. Tender testicle palpated near external opening of inguinal canal. Two days later operation. Tunica vaginalis filled with clotted blood. An hæmorrhagic testicle found twisted one and a half times from right to left. Mesorchium here appeared abnormally long. Testicle untwisted. Recovery.

(10) MIKULICZ-GERVAIS (Medical Press and Circular, 1892, p. 53). A boy, four years old, fell and injured testis. Two days later pain in left side, redness, vomiting, difficulty in urination.

Operation.—Orchidectomy.

(11) BRYANT (*Medico-Chirurgical Transactions*, London, Vol. lxxv, 1892, p. 247). Boy, fifteen years old. Went to bed as usual. He was awakened by pain in the scrotum and the groin. He vomited once. Tumor seen at the external abdominal ring. Thought to be a hernia. Taxis tried unsuccessfully. Three half twists were found in the cord. The testicle was warm and therefore was replaced. The testicle was exposed; black fluid blood escaped on opening the tunica vaginalis. Good healing occurred. The testis subsequently atrophied. The testis in this case was only partially descended.

(12) KEEN (*Medico-Chirurgical Transactions*, London, Vol. lxxv, 1892, p. 253). Man, twenty-three years old. A right reducible inguinal hernia and an undescended right testis. Vomiting three days, pain, tenderness, and swelling in the right groin. Thought the trouble was with his old hernia. A tumor appeared in right canal, part tympanitic and part solid and extremely tender. The skin over the tumor was inflamed.

Operation.—Orchidectomy. Recovery. The testicle had been rotated three half turns. A hæmatoma had formed just behind testis the size of the testis itself. A small amount of fluid existed about the tumor and testis. Pyogenic cocci found in serum about testis. The hæmatoma was in part gangrenous. The vessels thrombosed and many of them ruptured. Keen thinks that the attempt made to reduce the supposed hernia caused a torsion of the testis.

(13) DAVIES COLLEY (*British Medical Journal*, April 16, 1892, p. 811). A lad, fourteen years old, with an undescended right testis, had sudden pain in the right groin over the testis. Swelling occurred at the seat of pain. He vomited. The tumor was the size of a hen's egg, very tender. There was no impulse on coughing. The abdomen was normal. The left testis lay in the perineum. Operation found a sac filled with black fluid blood and presenting three tense, black, shining, but soft ovoid masses, and the testis below them. The cord was twisted three half turns to the left. The black mass above the testis was all there was remaining of the epididymis. The testis was unwound and stitched to the scrotal tissues. Later the testis sloughed.

(14) PAGE (*The Lancet*, London, July 30, 1892, p. 257). Boy, seventeen years old. He had a right congenital inguinal hernia, and was wearing a truss. Awakened from a deep sleep by pain in the scrotum, which felt swollen and tender. It was thought that the hernia had come down. He vomited once only. Later it was supposed that there was an orchitis. Local inflammatory signs increased. Scrotal tissues became œdematous. The temperature was normal.

Operation.—Orchidectomy. The testis was black and gangrenous, and the epididymis swollen and of a chocolate color. The cord was twisted two turns to the right. Recovery.

(15) ANDERS (*St. Petersburger medicinische Wochenschrift*, 1892, No. 47, p. 437). Boy, thirteen years old. Left undescended testicle. Operation for orchidectomy on account of acute symptoms resembling those of an incarcerated hernia. The sac contained a clear fluid and a blue-black

tumor, the testis. Cutting the external ring enabled the twist in the cord to be untwisted. Recovery. This boy had worn a truss many years, supposing that he had a hernia.

(16) JOHNSON (*ANNALS OF SURGERY*, Vol. xvii, March, 1893, p. 282). Man, twenty years old; had a left inguinal hernia. Painful tumor in scrotum following blowing hard on a cornet, which pushed down the hernia. Vomited, and had pain over the tumor. Crackling over tumor.

Operation.—Orchidectomy. Testis gangrenous and emphysematous. Recovery.

(17) NASH (*British Medical Journal*, April 8, 1893, p. 742). A boy, nineteen years old, after considerable exercise, had pain in the right testicle after he went to bed. The pain extended along the spermatic cord. He vomited. The testicle and epididymis were swollen and tender. Above the epididymis was a small, tender swelling in the cord itself. The epididymis lay in front of the testis. It was thought best to untwist the cord. This was done one hour after the initial symptoms and with complete relief. In a few minutes after untwisting the cord, all swelling had gone. All faintness and pallor passed away. Recovery.

(18) BARKER (*The Lancet*, London, April 8, 1893, p. 792). Boy, fifteen years old. The right testicle always small and not fully descended. A rupture on the right side, which descended to the scrotum. He had never worn a truss. Temperature, 102.2° F.; pulse, 96. Vomiting. Pain in region of right testicle, which was swollen to many times its normal size; above this swelling of the testicle was a swelling in the inguinal canal, which was hard and tender and the skin over it dark and oedematous. This was thought to be a case of strangulated omental hernia. The sac was opened, bloody clots were evacuated, and the dark, livid, swollen testis seen lying with the twisted cord above it. No hernia was down at the time. Orchidectomy.

(19) OWEN (*The Lancet*, London, November 18, 1893, p. 1247). Boy, thirteen years old. An undescended left testicle. After playing at cricket, sudden swelling in inguinal canal. Vomiting. Tender swelling outside left abdominal ring, the size of a small hen's egg. No impulse to this swelling. The cord and external ring were clear, therefore it was not a hernia.

Operation.—Blood-stained fluid evacuated from the tunica vaginalis. Gangrenous testis at bottom of the cavity. A twist of the cord above the testis was discovered after an orchidectomy was done, and above the twist in the cord was a collection of bloody fluid, which escaped as the twist was relieved. A capacious tunica vaginalis, which had been included and shut off in the twist. Recovery.

(20) LANGENSTEIN (*Sammlung klinischer Vorträge*, 1894, No. 92). Man, twenty-five years old; a right undescended testis; after lifting, had a sharp pain in abdomen on the right side low down, followed by vomiting and a number of bowel movements. Two days later, a tumor, size of a hen's egg, along Poupart's ligament on the right side, tympanitic on percussion.

Operation.—Sac opened and found to contain bloody serum, clots, and a dark testis. A twist of the cord was found to exist near to the testis from right to left. Orchidectomy. No external ring seen. The internal

ring was closed. The processus of peritoneum had not reached the scrotum, but was at the level of the external ring.

(21) LEXER (*Archiv für klinische Chirurgie*, 1894, Band xlviii, Heft 1, p. 201). Man, sixty years old; attacks of swelling and pain in the left testicle for several (three) years; two weeks previous to this time testicle became swollen again and continued swollen and painful. The left scrotum was filled with a tumor the size of a child's head, tense, fluctuating; the skin was red, oedematous, and adherent. Orchidectomy. Thickened tunica, bloody fluid, black testis were found. The cord was twisted from left to right. Recovery.

(22) LAUERS (*Ann. Soc. Belge de Chir., Bruxelles*, 1894). Boy, fifteen years old; sharp, severe, left inguinal pain. Hour-glass swelling in left side of scrotum, painful and fluctuating. Orchidectomy. Torsion of the cord present. Recovery.

(23) VAN DER POEL (*New York Medical Record*, June 15, 1895). A man, twenty-five years old. Delayed descent of the right testis. For three years, at irregular intervals, sometimes at night when asleep, sometimes in the day-time, was suddenly seized with acute pain in the right testis, radiating along the cord and canal. The testis, epididymis, and cord feel sensitive, hard, and knotty. Stroking the cord upward or lifting the testicle upward caused the pain to subside after eight or ten minutes. The twist has been from right to left, and by rotating the testis from left to right he has secured relief. The testis was found to have twisted two full turns upon itself. Van der Poel found that he could rotate the right testis three complete half turns in either direction without causing pain, and the testis would remain in this position; whereas he could rotate the left testis but a little over one complete circle without pain, and that it would return immediately to its natural position when released. An incomplete reducible inguinal hernia existed on the same side, which a truss held perfectly.

(24) HELFERICH and ENDERLEN (*Deutsche Zeitschrift für Chirurgie*, Leipzig, 1896, Band xliii, 177-186). Aged forty-nine years. Occasionally noticed that right testicle was higher than left. While lifting a heavy piece of iron, had sudden knife-like pains in abdomen, pains also the next day. Two days after onset, on attempting to work again, pain returned, chiefly in inguinal region. At this time a swelling was noticed in right inguinal region extending into scrotum. Testicle could not be felt.

Operation.—Bloody fluid in the tunica vaginalis. Testicle bluish red. Cord twisted from within outward 270 degrees, and the testicle, in addition, was somewhat twisted on its transverse axis. When the testicle was untwisted, it had a tendency to return to its twisted position, just as in Anders's case. Castration. The testicle was enlarged and the seat of a carcinoma involving the entire testicle. There was also slight flattening of the testicle which favored the torsion, and the ordinary fixation by the mesorchium was absent.

(25) SANDERS (*Medical Mirror*, St. Louis, 1896, Vol. iii, p. 114). Man, thirty-eight years old; suddenly taken ill five days previously with pain in right inguinal region; vomiting; temperature 101° F.; pulse, 114. Irregular oblong tumor in the right inguinal region and upper part of scrotum,

dull on percussion, tender. No impulse upon coughing. Taxis was unavailing. Orchidectomy. A sac filled with blood-clot, black testis, and epididymis. Recovery.

(26) TAYLOR (British Medical Journal, February 20, 1897). Child at birth presented a swelling in the right scrotum. The right testicle was large and more tense than normal. Because of the great pain and existing convulsions, orchidectomy was done. The sac of the tunica vaginalis was filled with liquid and clotted blood. The testis and epididymis were black. Recovery.

(27) MACAIGNE et VANVERTS (Société Anatomique, 1898, p. 267). Boy, aged fifteen years. Left testicle never descended. Swelling appeared in left inguinal region accompanied by pain and vomiting. At end of twenty-four hours swelling disappeared and symptoms ceased. Four months later a return of the pain, but no swelling. Two months later a third attack of pain, vomiting, and swelling size of pigeon's egg. Diagnosis of strangulated testicle with probable torsion of cord.

Operation.—Small sac containing bloody serum and also testicle, both in inguinal canal, with cord twisted one and a half times from above downward and from right to left. Orchidectomy. Recovery.

(28) BAROZZI (Bull. Société Anat. de Paris, 1898, pp. 188-190). Aged thirty-seven years. Sudden onset of severe pain in right inguinal region accompanied by nausea, but no vomiting. No appreciable cause for the onset. The testicle was not ectopic.

Examination three days later showed a tumor in right scrotum resembling an hæmatocele. It was prolonged upward along the cord to the opening of inguinal canal in the form of a diffuse induration quite tender to pressure. No diagnosis made.

Operation.—Considerable bloody serous fluid in the tunica vaginalis. Cord so twisted that it was almost divided. Testicle black. Orchidectomy. Recovery.

(29) SCUDDER. A boy, sixteen years old, previously strong and well. May 10, 1900, was hit in the testicle while playing base-ball. He had considerable pain, some fever, and moderate swelling of the testicle on the left side. These symptoms gradually subsided, and four days later he was allowed to be about. He resumed his school work. Two weeks passed with no attention being paid by him, his parents, or a physician to the testicle or the left side of the scrotum. After romping and playing as usual, he came home tired and complained of severe pain in the left side of the scrotum. The signs noted immediately after the injury were present at this time, namely, pain, swelling, tenderness, fever, and in addition a chill. After four days operation was done for what appeared to be an abscess of the scrotum connected with the testicle. Orchidectomy. Recovery was uneventful. Upon operating, the sac of the tunica vaginalis was found to be larger than usual, distended with blood-clot, liquid blood, and fluid. The skin over the swelling was œdematous and much infiltrated. The testicle was bluish black in color and the cord was twisted two half turns above the epididymis, as is very well shown in the illustration.

(30) HELFERICH (reported in the Clinic at Greifswald). Aged twenty-one years. Onset with violent pains in the right inguinal region, attributed

by patient to his efforts some days before to leap over a ditch. Inguinal swelling treated with ice for four days, and then patient went to hospital. Examination showed right testicle located in groin, swelling size of pigeon's egg and tender.

Operation.—In a sort of cyst, the size of an egg, was found a little fluid, bloody and cloudy, also a swollen testicle, dark red in color, and the cord twisted 360 degrees to the left. Orchidectomy. The cord here was composed of two parts. Gangrene had already begun in the testicle.

(31) MIKULICZ (reported in Clinic at Königsberg). Child, aged four



Scudder's case of strangulation of the testis by rotation of the spermatic cords; appearance of the testicle, epididymis, and cord as seen immediately after their removal.

years; fell twelve feet. Two days after accident, pains in left lower abdomen. The third day swelling and redness of scrotum, with a little swelling along the left spermatic cord. In left scrotum was a hard swelling, sensitive to pressure and adherent to skin. Torsion of the cord was thought of.

Operation.—A little yellowish exudate in tunica vaginalis and a small ecchymosis on its external surface. Testicle violet. Some dilated veins on the head and body of the epididymis. The tail of epididymis and the beginning of the cord presented a torsion of 360 degrees. Torsion easily

reduced. Mesorchium six centimetres long. Part of the testicle sloughed. Recovery.

(32) DEFONTAINE (Arch. Prov. de Chir., Vol. iii, p. 137, Paris). Child, eight months old. Painful tumor, pigeon's egg in size, in left scrotum extending to the external ring, had been present for hours. Vomiting and fretfulness present. Thought to be a strangulated hernia.

Operation.—Twisted cord, testis swollen. Twist untwisted, testis allowed to remain. Recovery. Five and a half months later there was an atrophy of this testis.

The case of Volkmann and the two cases of Englisch should be recorded in this connection, for they may be of value later in throwing some light upon the pathology of this affection.

VOLKMANN (Berliner klinische Wochenschrift, 1877, p. 769). *Acute Hamorrhagic Infarction and Spontaneous Gangrene of the Testicle*. Aged fifteen years. Without apparent cause, sudden onset of severe abdominal pain with diarrhœa and vomiting. The next morning the left side of scrotum was swollen and the pain was limited to the left testicle. Fever, thirst, and headache. Three days after onset entered hospital. Scrotum swollen, with a hard, inflammatory œdema, about double the size of a man's fist, and on the left side deep red, tender, and hot. Diagnosis of acute purulent inflammation of the left tunica vaginalis.

Operation.—Much œdema of scrotum. About a teaspoonful of clear, fluid, dark blood. Testicle four or five times its normal size and dull blackish red, with smooth, glistening surface. A long mesorchium. Epididymis, a blue-black-red. The blood in the pampiniform plexus coagulated. Expectant treatment, leaving the wound open. Testicle and epididymis became necrotic, and gradually dried up and dropped off. Recovery.

Microscopic examination of parts of testicle showed no inflammatory process. No mention of any twist of cord.

ENGLISCH (Wiener klinische Wochenschrift, 1893, pages 603, 625). *Hamorrhagic Infarction of Testicle and Epididymis*.

CASE I.—Aged sixteen years. In the night sudden swelling of left scrotum without known cause. The testicle and epididymis became enlarged, and the infiltration extended in the cord up to the inguinal canal. Tenderness present. Redness of the skin. Symptoms gradually disappeared. No operation; considered a case of hæmorrhagic infarction.

CASE II.—Aged seventeen years; first felt a sensation of pressure in left testicle, and some hours later severe pain accompanied by swelling. Tenderness extended up to iliac fossa. Redness and œdema.

Operation.—Testicle found attached to posterior wall by broad mesorchium. No induration of pampiniform plexus. Brownish-red fluid in tunica vaginalis. Testicle and epididymis both blackish red. Drained. Testicle sloughed, and also part of the epididymis.

Diagnosis same as in first case above. Cause unknown. Some infec-

tious process, with thrombosis of veins, perhaps. Twisting of cord also mentioned as an occasional cause of such gangrene of testicle.

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FRACTURE OF THE CARPAL END OF THE RADIUS, WITH FISSURE OR FRACTURE OF THE LOWER END OF THE ULNA, AND OTHER ASSOCIATED INJURIES.

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SCARCELY five years have elapsed since the Röntgen rays began their triumphant march at the modest town on the Main and the doctrine of fractures has been compelled to change its whole physiognomy. It is significant that the progress of our

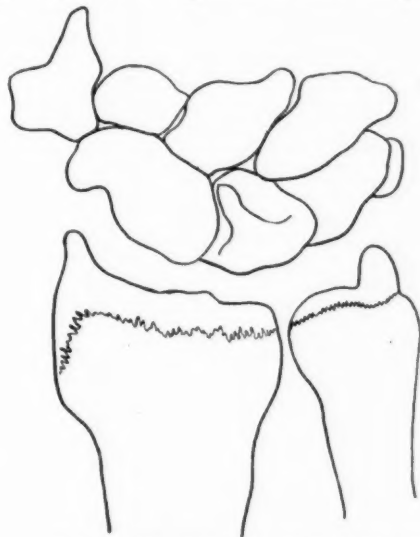


FIG. I.—Osteo-epiphyseal separation (Schematic).

pathologic knowledge has in general altered a great many clinical pictures, and in extending our diagnostic horizon has simplified our therapy. But especially in regard to our under-

standing of fractures a revolutionary metamorphosis has taken place, and it is gratifying to note that with the clearing up of the anatomic conditions by the miraculous rays, the ratio between therapy and pathologic knowledge has been altered by a great increase in the latter.

It is an old dictum that the largest number of medications is recommended for such ailments which are least understood. Fractures are no exception to this rule. The degree of diagnostic deficiency could be estimated by the number and complicated shape of the various splint apparatus.

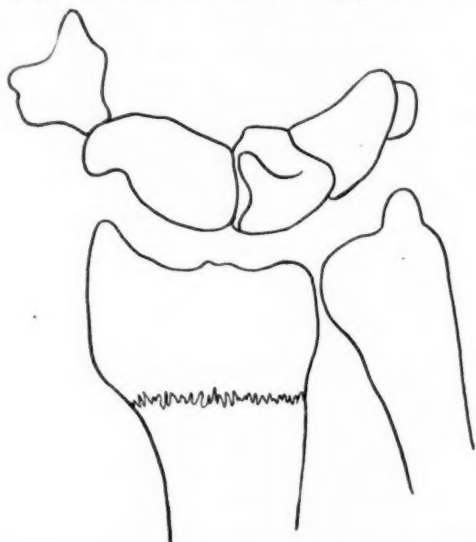


FIG. 2.—Fissure (fracture without displacement).

The clearer the understanding becomes of the genesis and the relations of a fracture type the more do the manifold therapeutic *recipes* shrink into a few simple principles which in fact could be written on a finger-nail, like the classic prescriptions of our great medical ancestor. No fracture has provoked the loving interest of the various splint-inventors to such an extent as that of the carpal end of the radius. I may only mention the well-known splints of Von Dumreicher, Roser, Schede, Braatz, Gordon, Koelliker, Moore, Carr, Bond, Middeldorpf's bilateral, and Nélaton's pistol splint.

And in no fracture type were the Röntgen rays more urgently needed to realize how often we have erred in its true recognition. The increasing capacity of recognizing their own errors has become a continuous source of scientific satisfaction, which found its culmination in the blameless results of these cases, for all those colleagues, who soon appreciated the immense value of one of the greatest discoveries of all times. "Our sight," says Addison, "is the most perfect of our

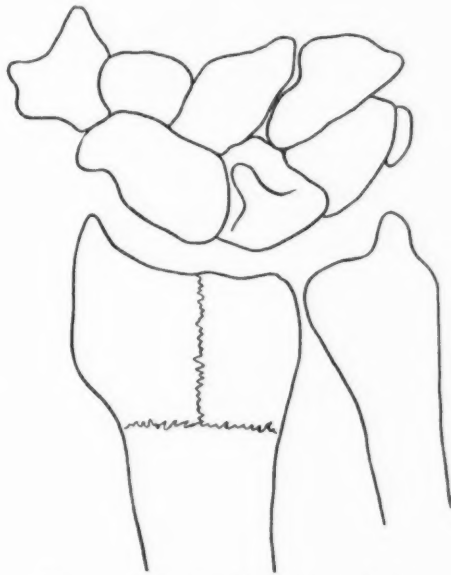


FIG. 3.—T-fracture (intra-articular).

senses," and the small flock of Thomases who imagine that by virtue of their own especially developed palpatory talent they can just as well judge any fracture without the aid of the Röntgen rays, will not escape, in the course of time, the natural shrinking of their cell-walls. They will share the fate of anti-asepticists and of obstructionists in general.

When the microscope was invented, great authorities used to speak with unutterable contempt of it, and others denounced anaesthesia as an unscriptural procedure. When Helmholtz invented the ophthalmoscope, some of those who hear the grass

grow pronounced it to be a nice little thing, which might be useful for bad eyesight, while they themselves, thank God, enjoyed good eyesight, and had no need of this new acquisition for their diagnostic armamentarium. *Sic transit ignorantia mundi.*

In the short space of time which has elapsed now since Röntgen's discovery, it has been found that the anatomic aspect

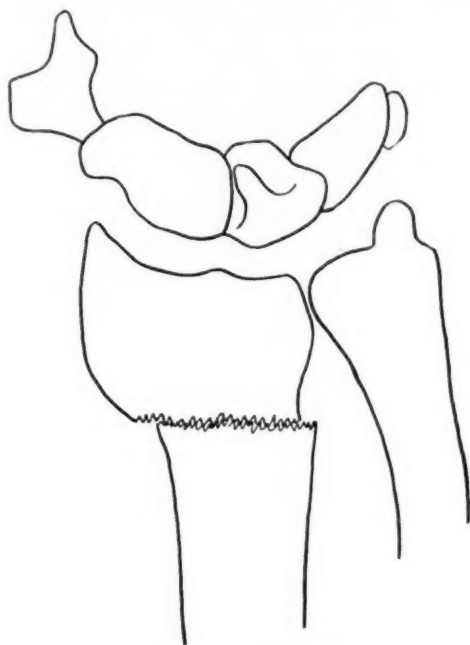


FIG. 4.—Simple fracture (Colles's) showing slight degree of displacement (extra-articular.).

of the fracture of the carpal end of the radius (*fractura radii loco classico*, inaccurately usually called Colles's fracture) does not show a uniform type, but in fact differs more than those of any other fractures.

A breach of continuity, about one to one and a half inches above the articular surface of the carpal epiphysis, causes, on account of a peculiar turn of the lower fragment, that deformity of the wrist which is compared with a fork (*displacement à la fourchette*), or with a bayonet, or with a flat Z. But

while it may be admitted that the majority of the cases of fracture of the carpal end of the radius represent this type, first described by Colles, there still remains a large group which differs from it materially.

In the first place, the question whether the fracture line is intra- or extra-articular, is of great practical importance, because for a simple fracture and a T-shaped intra-articular fracture different therapeutic means must be sought.

The limits of this article forbid my entering into details. I may remark only that in former publications on this subject, I proposed classification as follows:

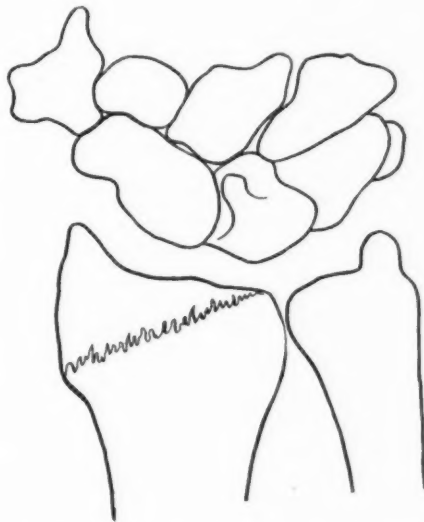


FIG. 5.—Simple fracture without displacement (intra-articular).

(1) Epiphyseal (chondro-epiphyseal and osteo-epiphyseal) separation (Fig. 1); (2) fissure (Fig. 2); (3) complete fracture (simple and multiple) (Figs. 3, 4, 5); (4) incomplete fracture (infracture); (5) fracture of the carpal end of the radius combined with fracture of the styloid process of the ulna (Fig. 6); (6) fracture of the carpal end of the radius combined with fissure or fracture of the lower end of the ulna (Fig. 7); (7) fracture of the carpal end of the

radius combined with fissure or fracture of the scaphoid bone (Fig. 8) (also with the ulnar end sometimes). All these different varieties may be intra- as well as extra-articular. (8) Fracture of little bone portions (chips), generally extra-articular (Fig. 9).

The first modification which the Röntgen rays imposed on the anatomy of this fracture was my own discovery of a simultaneous injury of the lower end of the ulna (*International Medical Magazine*, May, 1897). Later observations (Colles's Fracture and the Röntgen Rays, *Medical News*, February 19,

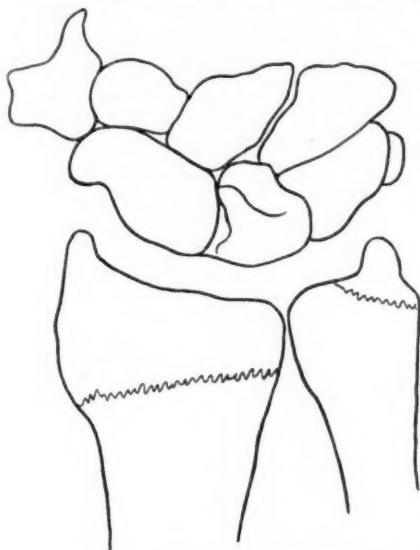


FIG. 6.—Fracture of the carpal end of radius combined with fracture of styloid process of ulna.

1898, Fracture of the Lower End of the Radius, *New York Medical Journal*, September 9 and 23, 1899, and Beiträge zur Fractur der carpalen Radius Epiphyse, Langenbeck's *Archiv*, Band lxiii, Heft 1) confirmed my first report. From February, 1896, till to-day I have had the opportunity to study 123 cases of fracture of the carpal end of the radius. Ulnar fissure was found twenty-six times (nearly always in adults), while the complete fracture was observed nine times (during the age from ten to eighteen years). Displacement of the ulnar frag-

ment was rarely present; in four cases it was, in fact, insignifi-

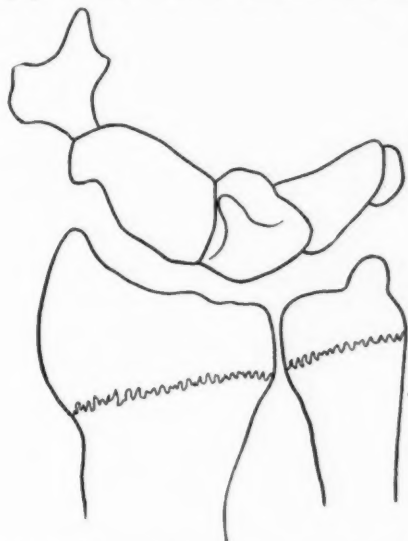


FIG. 7.—Fracture of carpal end of radius combined with fissure of lower end of ulna.



FIG. 8.—Fracture of carpal end of radius combined with fracture of the scaphoid bone.

cant. The direction of the line of fissure and fracture was

always transverse. The injury had invariably been caused by a fall upon the hand when in dorsal flexion, the history of the cases always pointing to a high degree of external violence.

The mechanism of the injury might be explained by inward rotation of the dorsal-flexed hand, which presses the radial fragment favorably against the lower ulnar fragment. Thus ulnar outward bending, the consequences of which are sometimes conspicuous after many years, is often produced.

Fig. 10 represents the case of a lady of fifty-eight years of

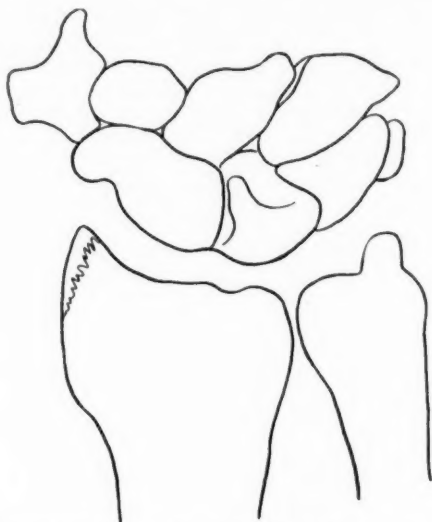


FIG. 9.—Bone-chips at the lower external surface of the radius.

age, who in falling from a considerable height sustained a T-fracture of the carpal end of the radius, which was followed by outward bending of the ulna. When I examined the wrist three weeks after the injury for the first time, I found the ulnar deformity much pronounced. Forcible counterpressure under ether anæsthesia corrected it, as it appears from the skiagraph taken six weeks after the injury. But more frequently, as far as my opinion goes, a tear through the ulnar head is produced.

Considering that in a case of simple fissure of the ulna the position of the fragments remains normal, as there is no dias-



FIG. 10.—Outward bending of ulna, caused by T (intra-articular) fracture of carpal end of radius, reduced.



FIG. 11.—Fracture of carpal end of radius, combined with fissure of the ulna and of the scaphoid bone.

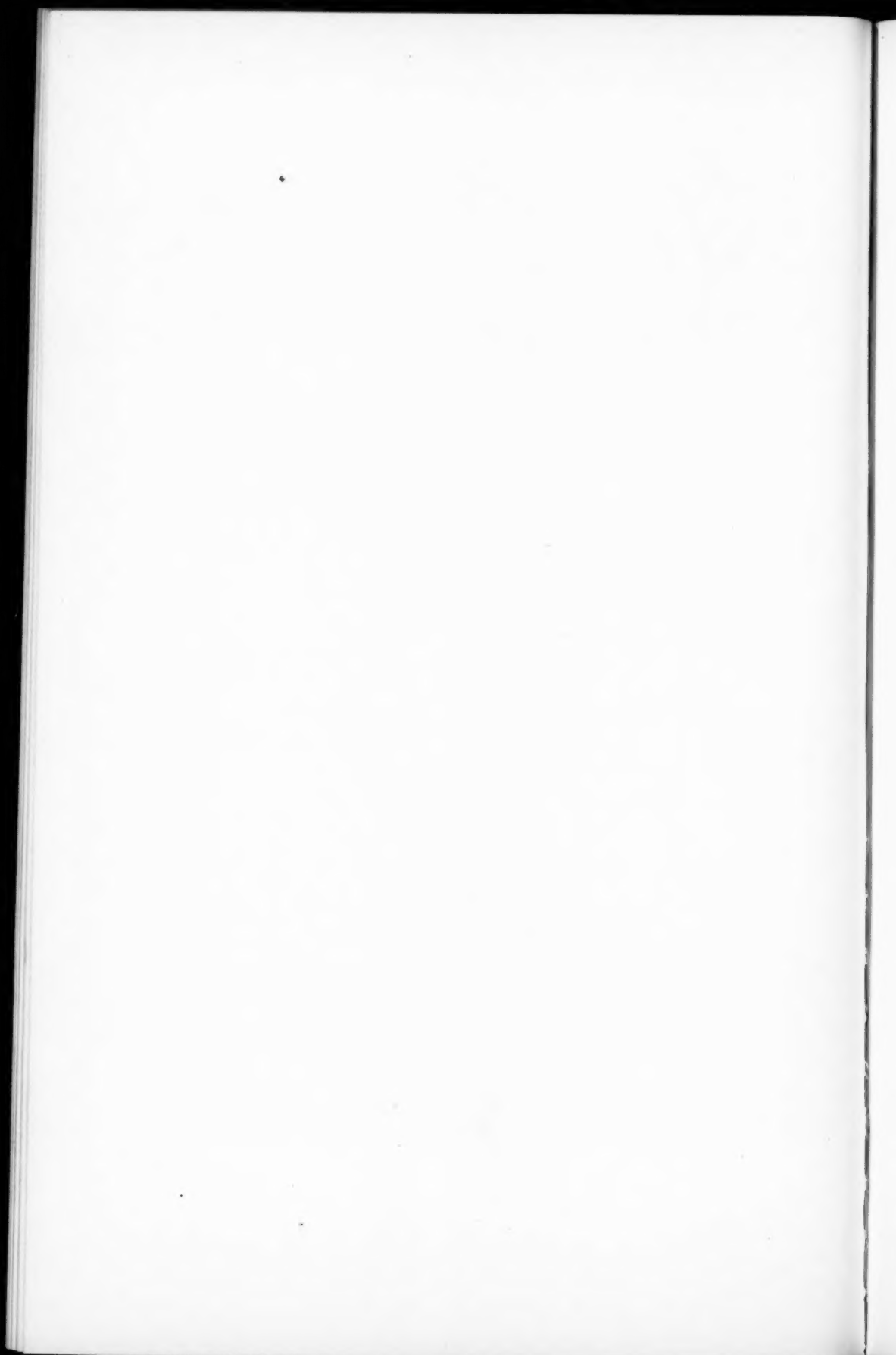
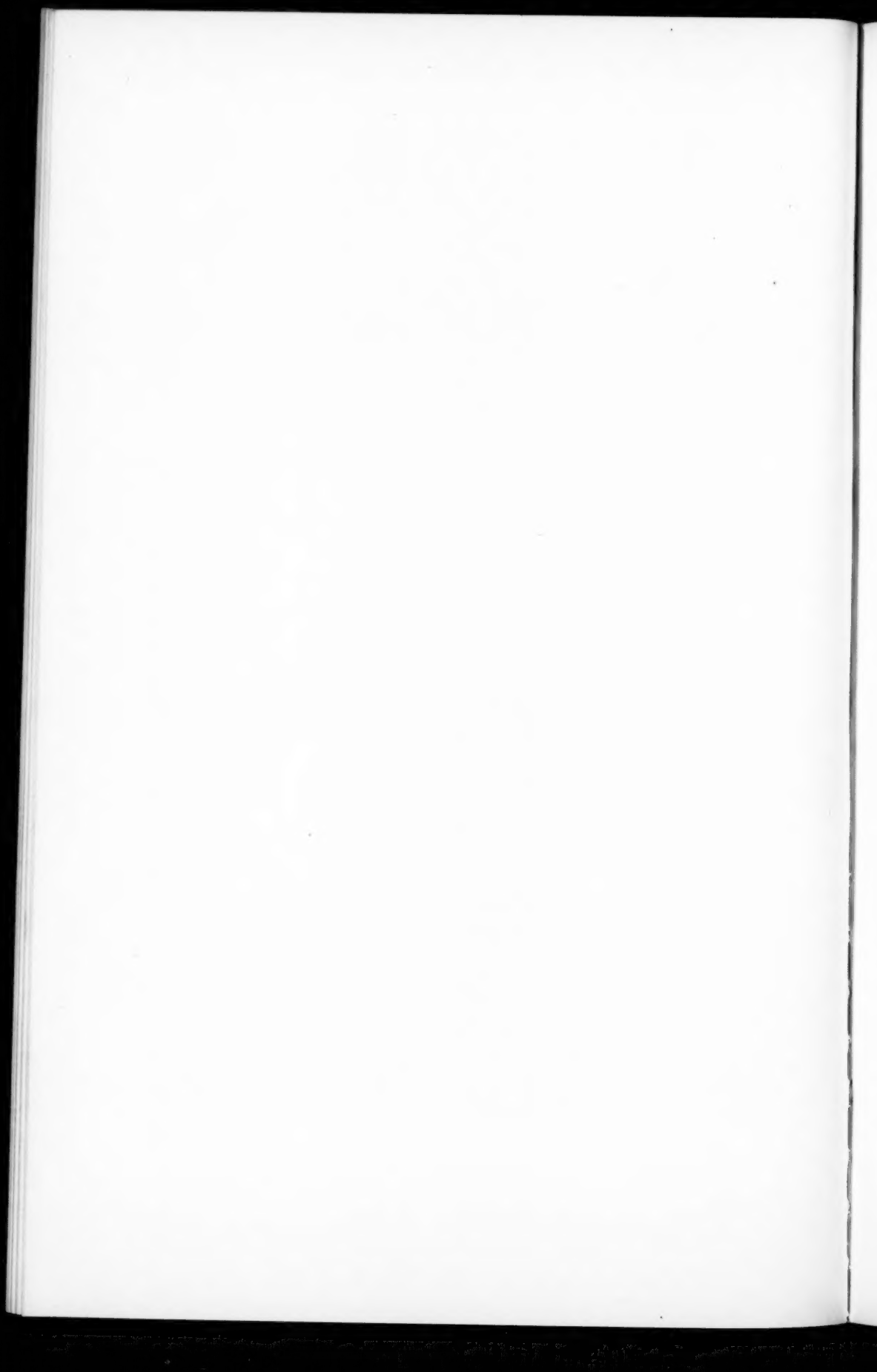




FIG. 12.—Fracture of the carpal end of the radius, combined with osteo-epiphyseal separation of the lower end of the ulna.



tasis, it is easy to see that a correct diagnosis before the Röntgen era was hardly possible.

The tear may in fact be so insignificant that only a very distinct skiagraph will show it, as is evident from Fig. 11, which represents the hand of a lady forty-five years of age who fell from a considerable height. The transverse ulnar fissure, which appears as a direct continuation of the radial fracture line, illustrates the continuation of the concussion from the radial fragment towards the ulnar portion.

Fig. 12 illustrates the left wrist of a boy, thirteen years of age, who fell backward when skating, two weeks before the skiagraph was taken. The radial fracture caused slight bending, which, however, was of sufficient force to cause osteo-epiphyseal separation of the ulna. The non-ossified epiphysis is pushed outward.

The simultaneous injury within the osseous sphere of the ulna is evident from the shade at the outer surface of the ulna, to which the tenderness of this region corresponds.

In Fig. 13 the influence of the radial fragment upon the epiphysis is still more pronounced. It represents the wrist of a boy of fourteen years who fell from a tree twenty-one days before the skiagraph was taken. He had been referred to me under the diagnosis of badly united radial fracture. There was but an insignificant outward bending of the ulna present, but pronation and supination were impeded. The phenomenon was explained by the skiagraph, which showed a thin osseous tie, or cross-beam, passing through the ulnar epiphysis and connecting into the callus of the radial fracture. This osseous band, which was the expression of the simultaneous fracture of the ulna, caused the impossibility of rotation; and the function of the wrist could only be restored by dividing it with a chisel.

Figs. 13, 14, and 15 illustrate a case of osteo-epiphyseal separation of the radius combined with fissure of the inner surface of the epiphyseal end of the ulna in a lad of sixteen years who had fallen down a stony stairway. By looking at Fig. 14 only, the impression of normal, non-ossified epiphysis must necessarily prevail.

Fig. 15, taken while the ulnar margin of the hand is slightly lifted, shows the presence of the fracture lines beyond doubt.

Fig. 16, which is skiagraphed in the lateral position, markedly illustrates the displacement of the fragments.

This is another proof of the absolute need, as stated on previous occasions, of taking at least two exposures in different positions in fracture cases.

Another technical point deserving attention is that if exposures are made immediately after a fracture is sustained, the fracture line is often not well marked, especially so if there is no displacement of the fragment. After a few days, when the callus formation begins, the line is more marked. Fig. 14, for instance, which shows hardly any evidence of the presence of a fracture, was taken one hour after the injury. The diagnosis of fracture could also be made without the aid of the Röntgen rays in this case, but the simultaneous injury of the ulna would certainly not have been recognized by the old method.

In Fig. 17 the fracture line was within the insertion of the synovialis, the scaphoid bone being fractured at the same time, which explains the extensive swelling produced by the intra-articular effusion. The patient was a woman of twenty-nine years of age, who in falling from a high stoop had twice struck the wrist against the stone.

A skiagraph taken twenty-four hours after the injury showed the presence of splinters between the radial fragments and of a fissure line above the ulnar head.

Without the aid of the Röntgen rays, neither the splinters nor the ulnar fissure would have been recognized. The coexistence of ulnar signs would have been accounted for by the radial injury alone. And if in former years, in view of the presence of a circumscribed swelling and tenderness, a simultaneous ulnar injury was recognized, it was in the sense of a contusion only. Of course, when the fracture is so pronounced as Figs. 17 and 20 show, the diagnosis is not difficult. Still, it was not made in both instances.

Fig. 18 illustrates the case of a boy of nine years who in

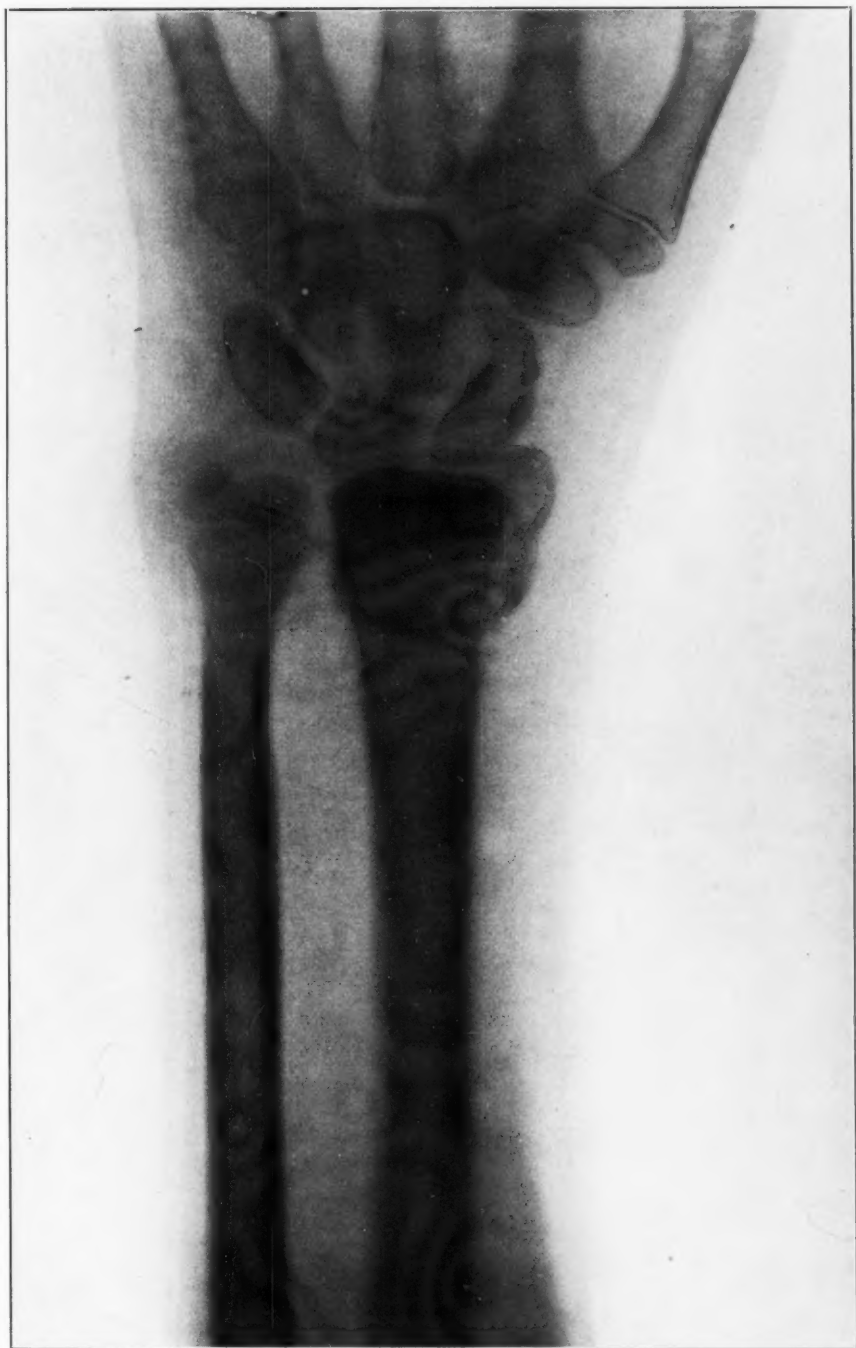


FIG. 13.—Fracture of carpal end of radius, combined with fissure of the ulnar epiphysis, causing synostosis.

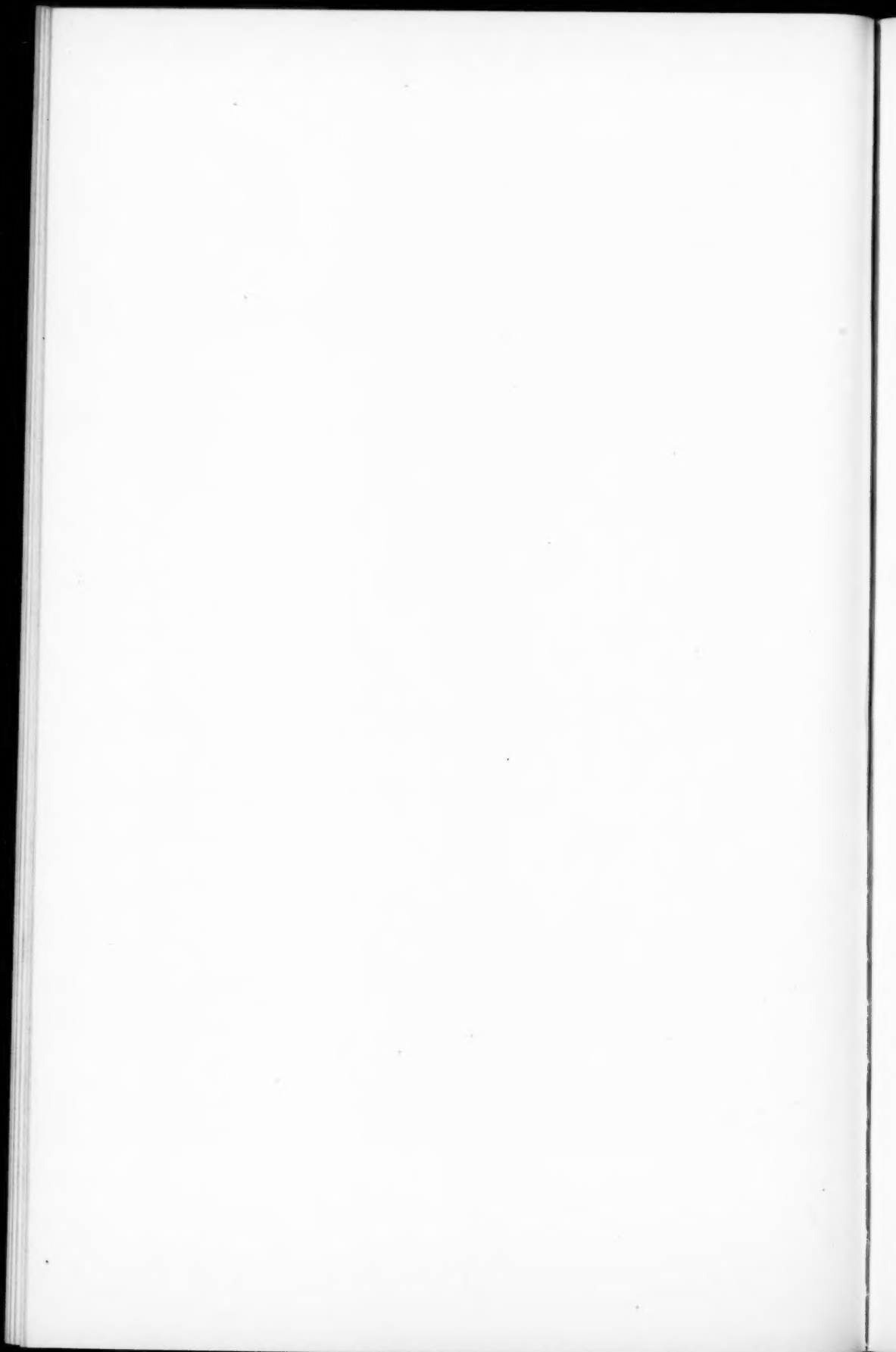


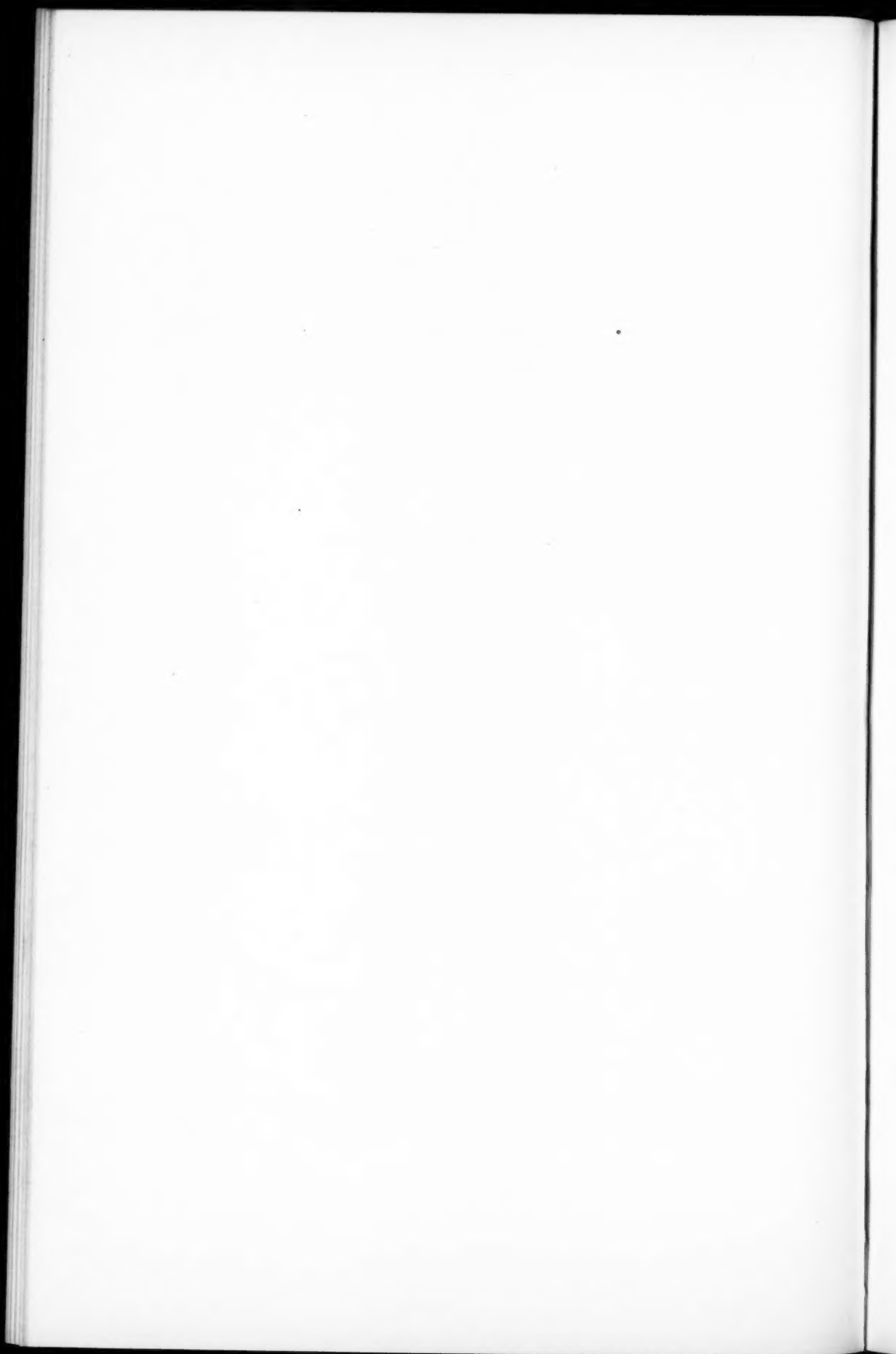


FIG. 14.—Apparently normal conditions in osteo-epiphyseal separation of carpal end of radius, combined with chondro-epiphyseal separation of the ulnar end.





FIG. 15.—Wrist, illustrated by Fig. 14, showing the fracture line by lifting the ulnar margin.



stumbling on the street fell against the edge of a side-walk. When I had the first opportunity of examining the patient three weeks after the accident, the signs of a radial fracture appeared pronounced on single inspection.

The regular continuity of the external surface of the ulna seemed to be uninterrupted on palpation. The abundant callus formation, so conspicuous on the skiagraph, could not be perceived, as it was veiled by the tissues of the interosseous space.

According to Fig. 18, the displacement seems to be insignificant, but Fig. 19, taken in the lateral position, showed the presence of dorsal deviation, and suggests the necessity of pressing the lower radial fragment downward.

Fig. 20 illustrates the case of a lad of eighteen years who fell from the roof of a small house. When I first saw the patient twenty-four days after the injury there was considerable swelling of the wrist and marked deformity, which was especially marked at the outer (radial) aspect of the wrist. At the ulnar surface a slight irregularity was noticeable. The skiagraph showed a considerable displacement of both bones, which were in a state of splintering, and a transverse fracture of the scaphoid bone. Naturally the displacement yielded to forcible bending under anæsthesia. Fig. 21, taken three weeks after refracture, shows ideal apposition of the ulnar fragments and fair restitution of the radial.

It was only in five of the cases of simultaneous ulnar fissure or fracture that I had the impression of a slight mobility, which, however, was not so well marked that the diagnosis could be made without the corroboration of the skiagram. Of course, as soon as the skiagram has given a clear anatomic representation of the condition, the palpatory impressions became more certain.

In view of the anatomic relations, it is natural that ulnar crepitus is never observed in these cases. Sometimes a slight ulnar deformity was noticeable, which was undoubtedly due to the presence of the bloody effusion within the fissure line. The tenderness localized in this sphere harmonized with this assumption.

From the study of my cases, I venture to draw the conclusion that in many cases of fracture of the carpal end of the radius, producing the so-called sideward pushing of the ulna, there is in fact a fissure or fracture of the ulna, which on account of its insufficient clinical signs was not recognized in former years.

My first observations were corroborated by Kahleyss (*Deutsche Zeitschrift für Chirurgie*, Band xlv, p. 531). I have no doubt that with the greater popularity of the Röntgen rays the comparative frequency of this lesion will be confirmed by many of my colleagues.

It should be borne in mind that only a very good tube reproduces the presence of a fissure clearly. A soft tube should be chosen, and the exposure should be long enough to show the structure of the bones distinctly and the soft tissues hardly at all, as, for instance, in Figs. 11, 14, 17, and 20.

It has repeatedly occurred to me that on account of a mediocre skiagraph, I was not able to detect a fissure line which appeared well pronounced in a blameless one. Such facts explain very well why some surgeons have disputed the reliability of other fellow-observers. Dr. A., for instance, insisting, and properly, upon his own diagnosis, while Dr. B., with his poor skiagraph of the same case, sneeringly asserts that he did not find the fissure line. Of course, Dr. B.'s opinion is thoroughly honest, but absolutely erroneous, nevertheless.

Especially during the first few days after the injury, as I have said, the presence of a fissure is easier overlooked than later, when callus formation begins. Only the most thorough observation brings out the necessary points with clearness; and it may be repeated that two synchronous exposures must be taken,—one in the dorso-palmar and one in the lateral radio-ulnar position. It is also advisable to make several exposures during different stages of after-treatment.

Now I hear a number of *confrères* say, "Well, this is all very nice and interesting, but wherein does the practical benefit of this detailed anatomic knowledge consist?" To this I must reply that the practical benefit is enormous, since we now

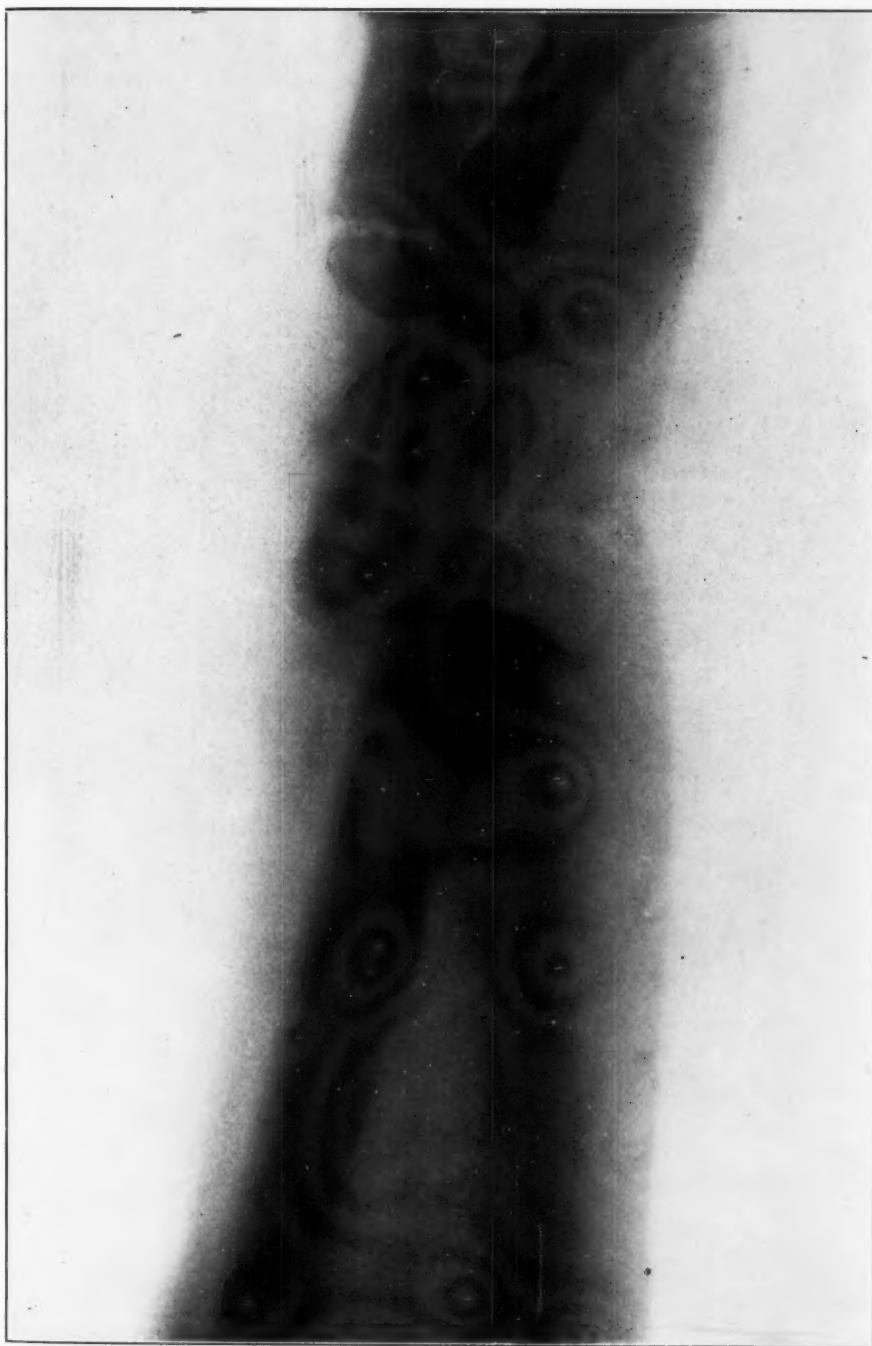


FIG. 16.—Wrist, illustrated by Figs. 14 and 15, showing considerable dorsal displacement, skiagraphed in the lateral position.

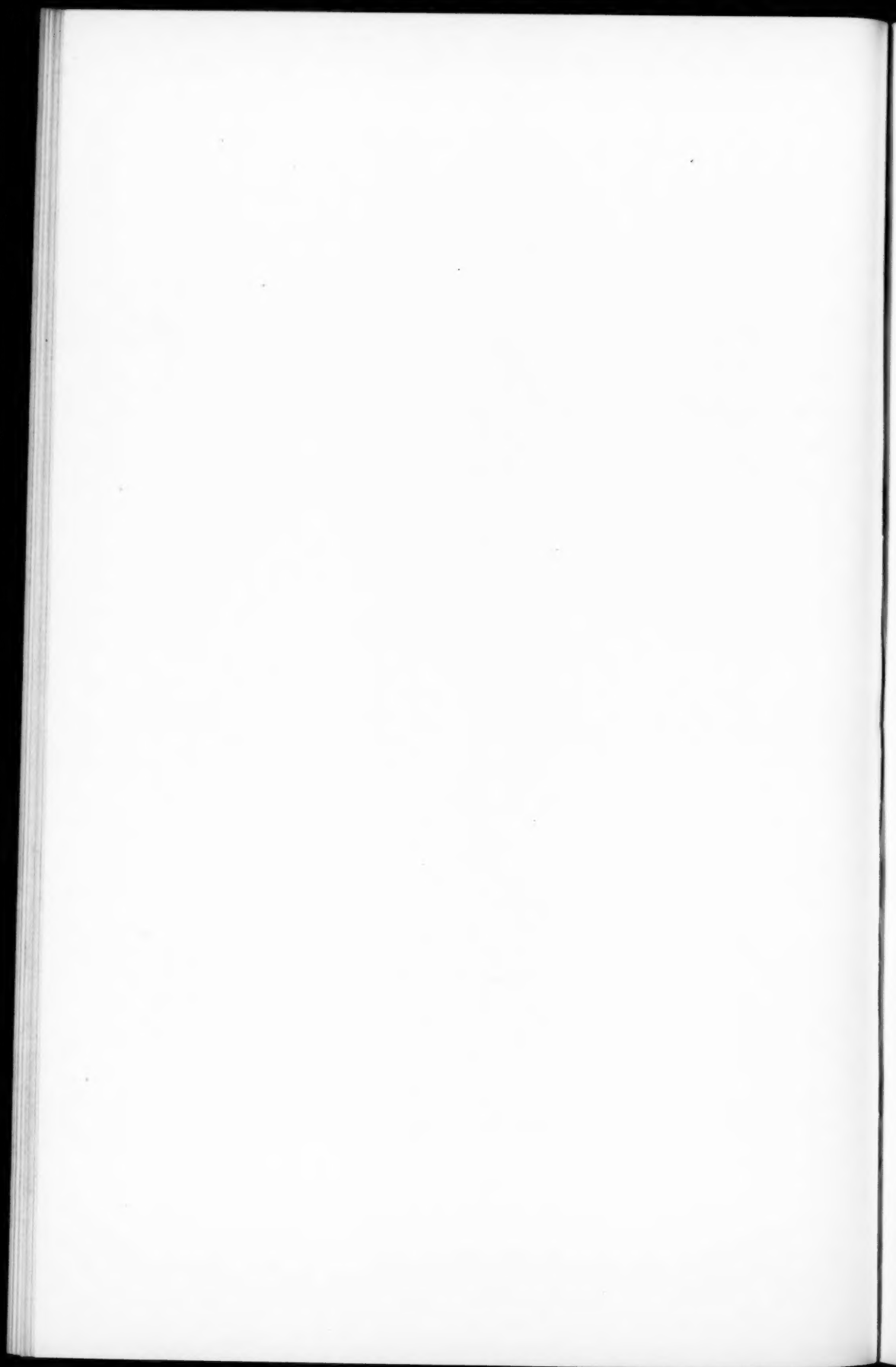




FIG. 17.—Fracture of the carpal end of the radius, combined with fissure of the ulnar head and transverse fracture of the scaphoid bone.

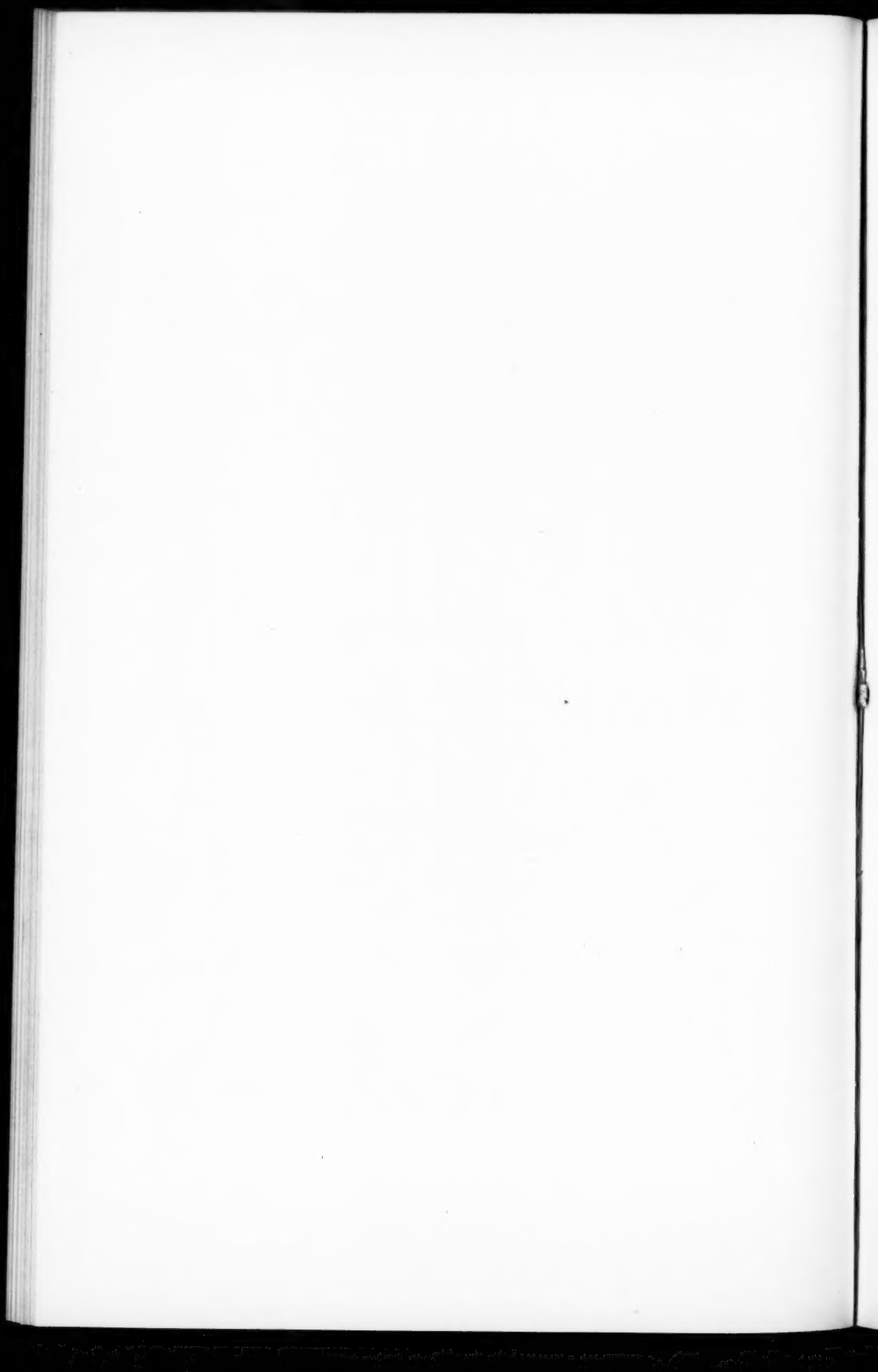
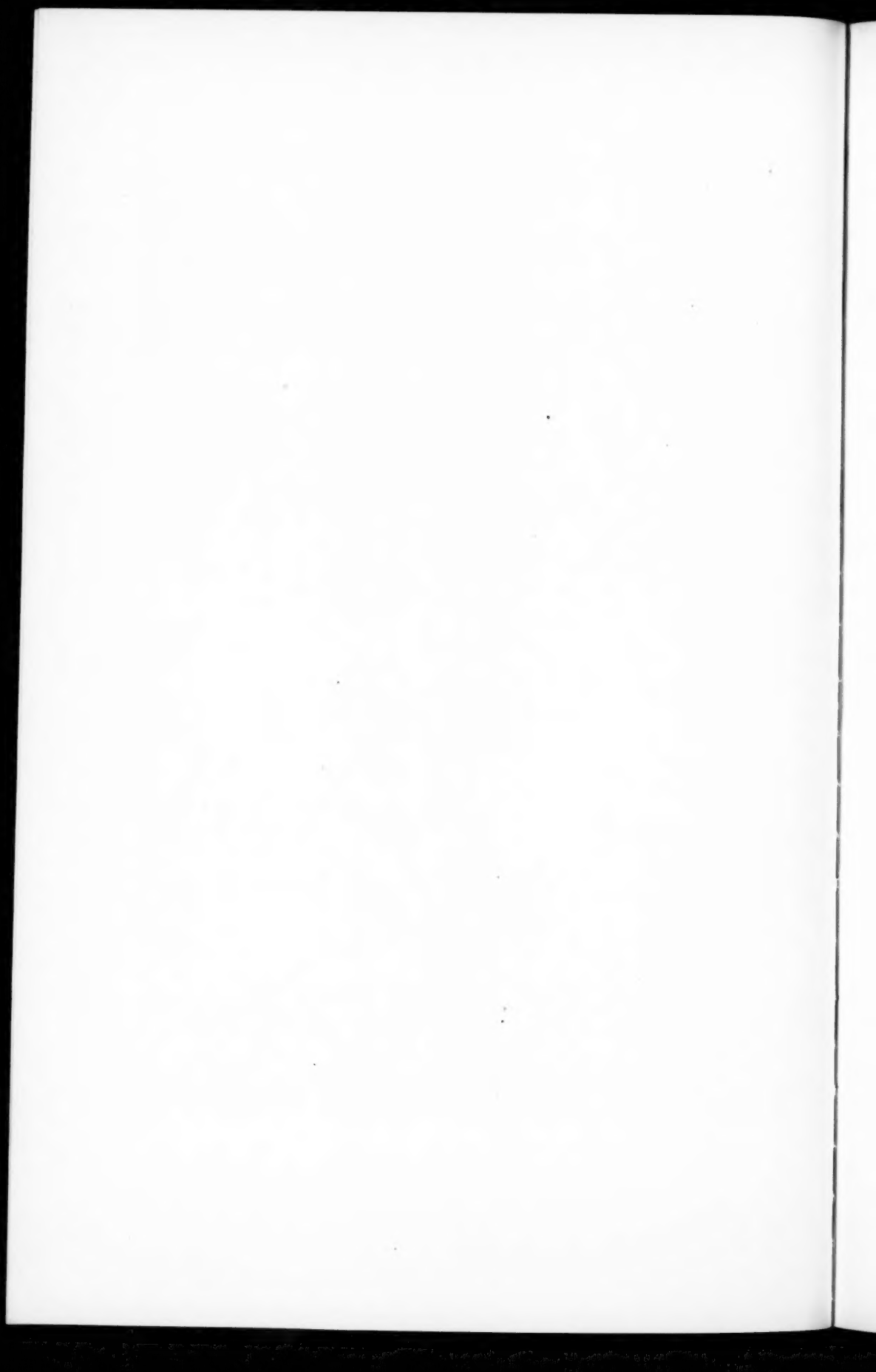




FIG. 18.—Fracture of the carpal epiphysis of radius, combined with complete fracture of the ulnar end.



understand why a simple fissure heals under, or in spite of, any treatment.

Wherever no tendency to displacement exists no replacement, or, to use an ordinary term, no reposition is required.

If the surgeon, led by anatomic knowledge, does the same that the quack does on account of his ignorance, namely, leave the healing process to Nature, so to say, the same good result may finally be obtained, a fact which I hope will not be learned by Christian scientists. The scientific treatment of the fissure will not alter any of its mechanism, but it will at least have the value of a greater or less comfort for the patient. Such comfort is obtained by encircling the wrist by a bracelet of moss-board. This appliance immobilizes the wrist sufficiently, and at the same time it permits enough motion to counteract the formation of adhesions in the sheaths of the tendons. The patient carries his hand in a sling in such a manner that the ulnar margin rests on it. Thus free motion of the hand is permitted. The patient is told to move his fingers as in playing the piano; and I find it very useful to advise him to grasp marbles of moderate size and to roll them around in the palm of the hand. Patients are generally willing to keep these marbles in their pockets, and play with them while reading or conversing or walking around. If motion is thus kept up constantly, massage treatment as well as forcible motion can be dispensed with, and recovery is perfect in four weeks or even before.

In complete fracture without tendency to displacement a plaster-of-Paris dressing may be applied immediately after the injury is sustained. But whenever displacement of the fragments takes place, accurate reposition is the condition *sine qua non*. This is done best by forced extension, the hand being grasped as in a firm hand-shake, with downward pressure by the surgeon's thumb, while counterextension is used on the forearm, which is flexed rectangularly. If an assistant is at hand, the surgeon grasps the four fingers with his left, and the thumb with his right hand, while the assistant uses counter-pressure at the elbow. If this procedure should fail, anæs-

thesia must be employed. If there is simultaneous injury of the lower end of the ulna showing displacement, like in Fig. 12, for instance, great care must be taken to press the fragment into its normal place.

Even in multiple fractures, especially in the much dreaded T-shaped variety (Figs. 3 and 10), the articular arch of the radius may be restored by repeated efforts of reposition controlled and corrected by the Röntgen rays. Even the routine surgeon is often astonished to find, after he had thought that he had accomplished a perfect reduction, how badly he has succeeded in his alleged reposition, one small item generally having been overlooked by him. Fortunately, malposition can often still be corrected after two or three weeks.

Keeping the fragments well adjusted in a proper position is quite difficult sometimes. I have, however, always been able to secure this by very simple methods. A long adaptable wire splint is applied while forced traction is made; the splint reaches at the flexor side of the arm from the tip of the fingers to the elbow. If the direction of the displacement is *upward* (silver-fork shape), a pad of adhesive plaster is attached to the dorsal integument above the fragment. Then a short, narrow splint of wood is applied on the dorsal aspect of the arm, reaching from the metacarpophalangeal joint to four inches above the wrist, and is kept pressing down by the application of a gauze bandage.

If the tendency to displacement is *downward*, the same procedure is carried out in the opposite manner, the wire splint being applied on the dorsal, and the wooden splint and pad on the palmar, side of the arm.

If the displacement be *sidewise*, which is most marked when there is a simultaneous injury of the ulna, immobilization must be carried out on entirely different lines. The adhesive plaster pad must then be applied laterally to the fragment, two long, narrow, wooden splints being used at the same time. One of these splints, being a little broader than the diameter of the bone, begins at the metacarpophalangeal joint of the thumb, and the other at the same point of the little finger; both ex-

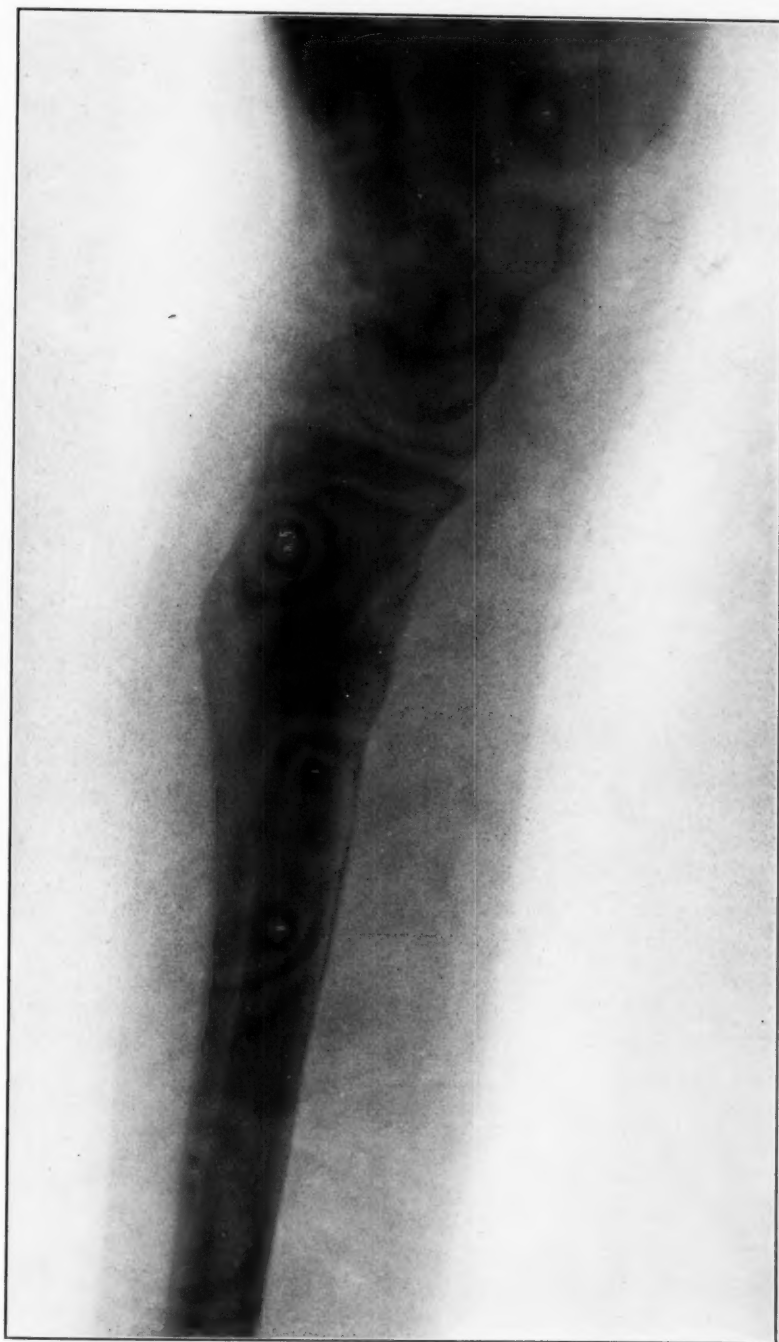


FIG. 19.—Wrist, illustrated by Fig. 18, showing dorsal displacement.

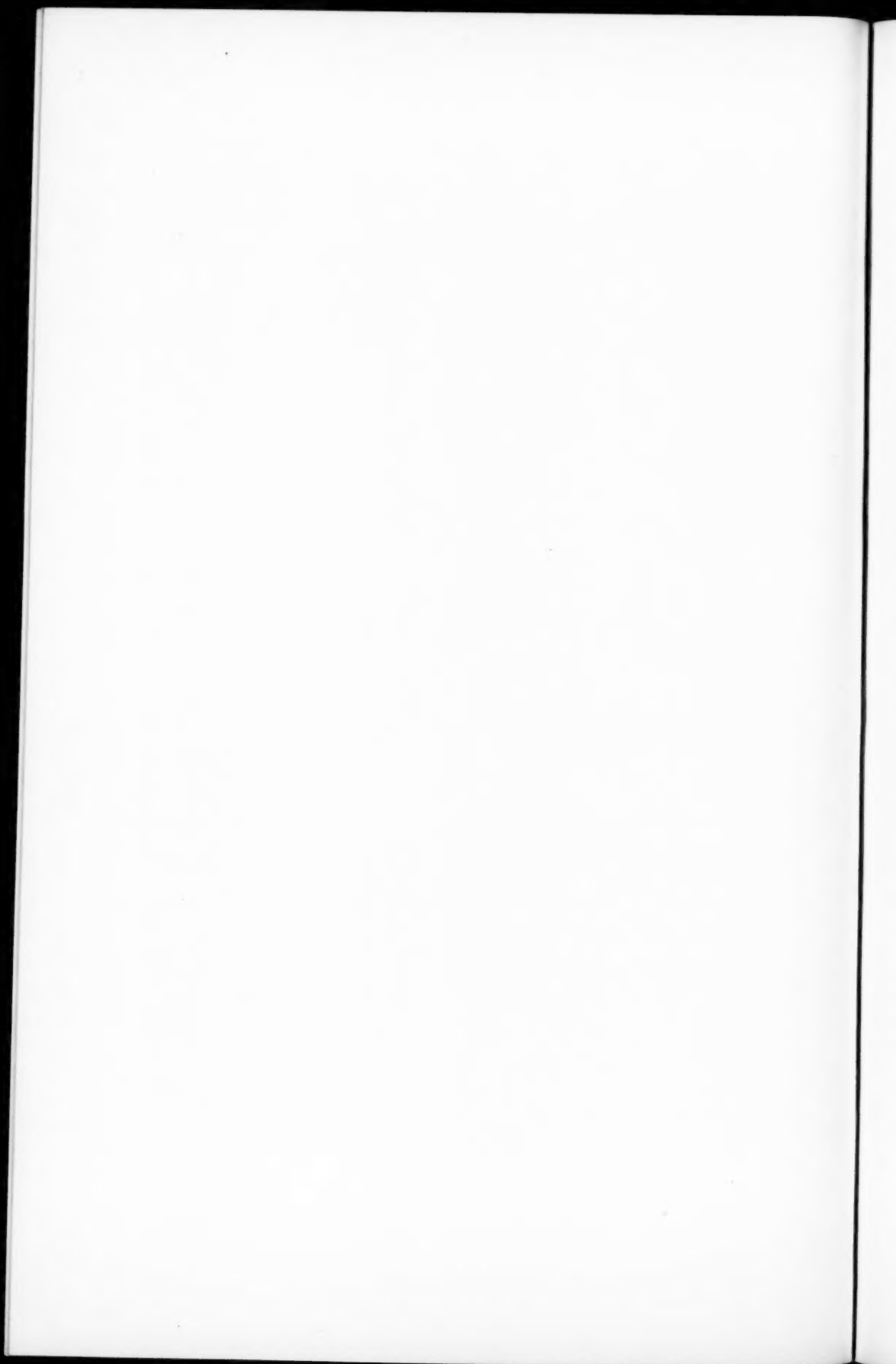
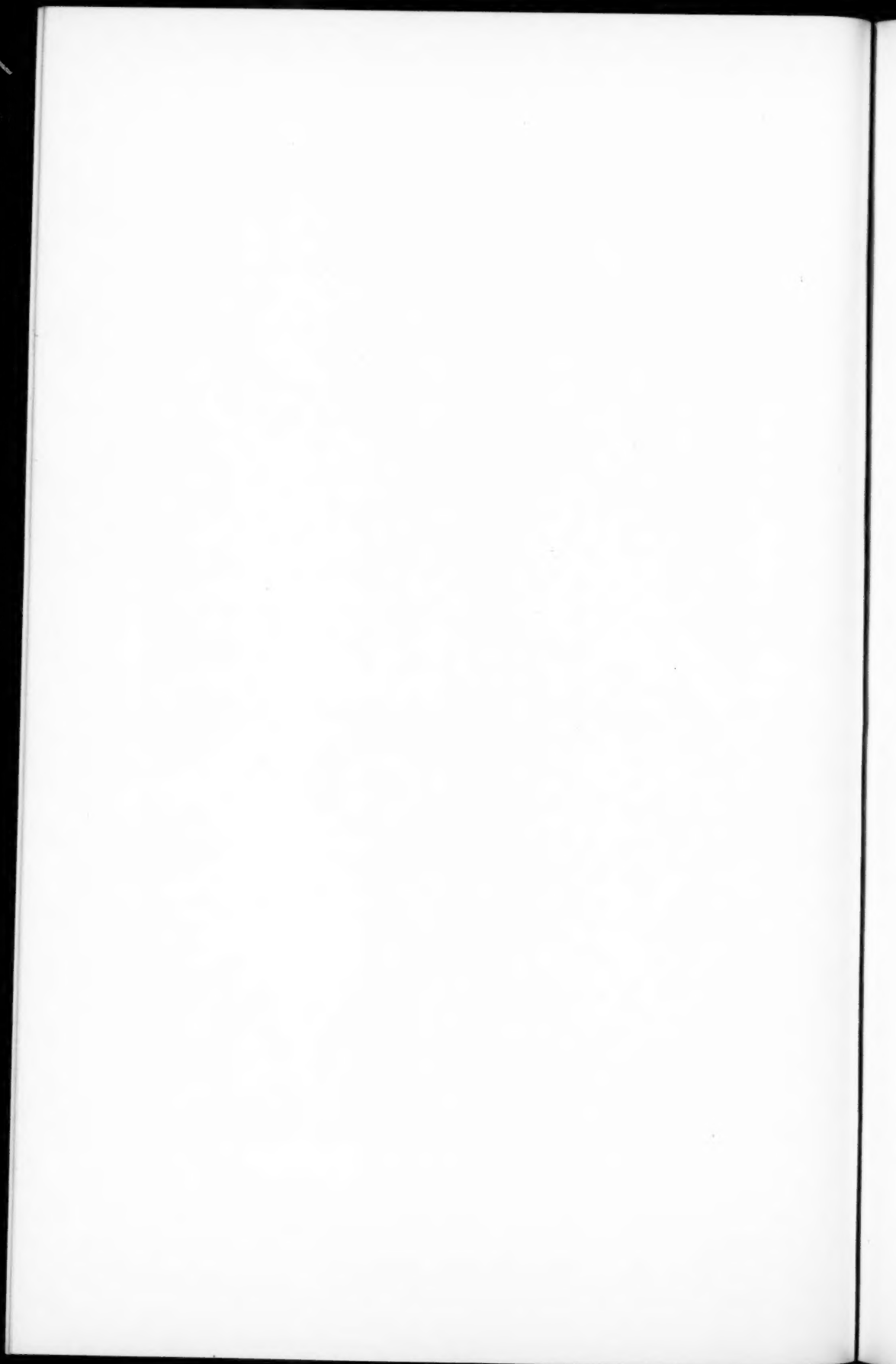




FIG. 20.—Displaced fracture of carpal epiphysis of radius, combined with splinter fracture of lower ulnar end and transverse fracture of the scaphoid bone.



tend up to the elbow, the same as the long wire splint. If there should be any displacement in the opposite direction, the pad must be applied on the ulnar side. No dorsal splint is used in this variety. After the dressing is finished, the skiagram verifies the proper position of the fragments. In case the tendency to displacement cannot be overcome, a plaster-of-Paris dressing is applied, while forcible extension and counterextension are used. Whether the position of the fragments is correct should be ascertained by the rays after the plaster-of-Paris dressing is applied.

If there be much swelling, wet applications may be advantageously used by pouring Burow's solution upon the gauze bandage, the wire splint permitting penetration of the fluid.

If after the lapse of a week agglutination of the fragments is obtained and no deformity is evident, then the soft tissues must receive consideration. It is only then that short splints are in order. They consist of well padded pieces of wood extending from the metacarpophalangeal joint up to the middle of the forearm. After another week, a bracelet, such as recommended for the treatment of simple fissure, is so applied as to permit of free motion of the fingers. The patient is also told to move his fingers as in playing the piano, also to use the marbles, as described in the treatment of the fissure.

After the third week massage treatment is indicated, active as well as passive motion of the joint being employed at the same time. The results of these simple methods are just as good, if not better, than those obtained by any of the numerous most complicated apparatuses often advised for the same purpose. If all the points of these manipulations dictated by simple common sense are observed, and if their proper execution is certified by the skiagram, surgical clinics will no longer furnish so much testimony of deformities and functional impairment following fracture of the lower end of the radius.

Of course, for the rich man who does no work, and for the laborer who does only rude work, the faulty position may be of little importance. But whoever must do delicate work will be greatly damaged by even a small degree of functional

disturbance. In fact, it is the displacement of the fragment, be it even very small, which causes the chain of later disturbance.

These doctrines are so simple that it seems almost unnecessary to repeat them; and yet they are frequently violated. The functional impairment following some fractures, especially the formation of adhesions in the vicinity of the joints, has led a number of surgeons to enunciate this dogma: "The most important part in the treatment of fracture is the treatment of the soft tissues." They claim, in other words, that because the function of the soft tissues, for instance, of the tendons, is impaired after a non-reduced fracture, the soft tissues should have received more attention, instead of the displaced fragment having been simply reduced to where it belongs. Nothing, in fact, is more contrary to common sense than this dangerous maxim, which is based upon correct observation but incorrect interpretation. It should always be considered that the relations of the soft tissues to the bones are like that of the clinging vine to the sturdy oak.

Galen says that the bones give the human body form, erectness, and firmness. It is evident that an injury of the bones impairs these three fundamental factors. The most important step towards repair must thus be taken in the foundations rather than in the superimposed structure.

If there is displacement of the bone fragments, undue pressure is necessarily made upon the soft tissues; *non-reduction means persistence of pressure*, the fatal consequences of which are well known. *Reduction means the relief of pressure*. Of course, the act of injury cannot be undone by the mere cessation of pressure; but the influence of the injury on the soft tissues—the influence of the pressure, in fact—lasts only a short time, and is insignificant after early reduction; there is then but little inflammation, consequently little exudation, and therefore repair is easy. This means that the premises of adhesion-formation are wanting. And clinical observation shows that if there was perfect reposition, the joints as well as the sheaths of the tendons are found free, provided the immo-



FIG. 21.—Case illustrated by Fig. 20 after refracture.

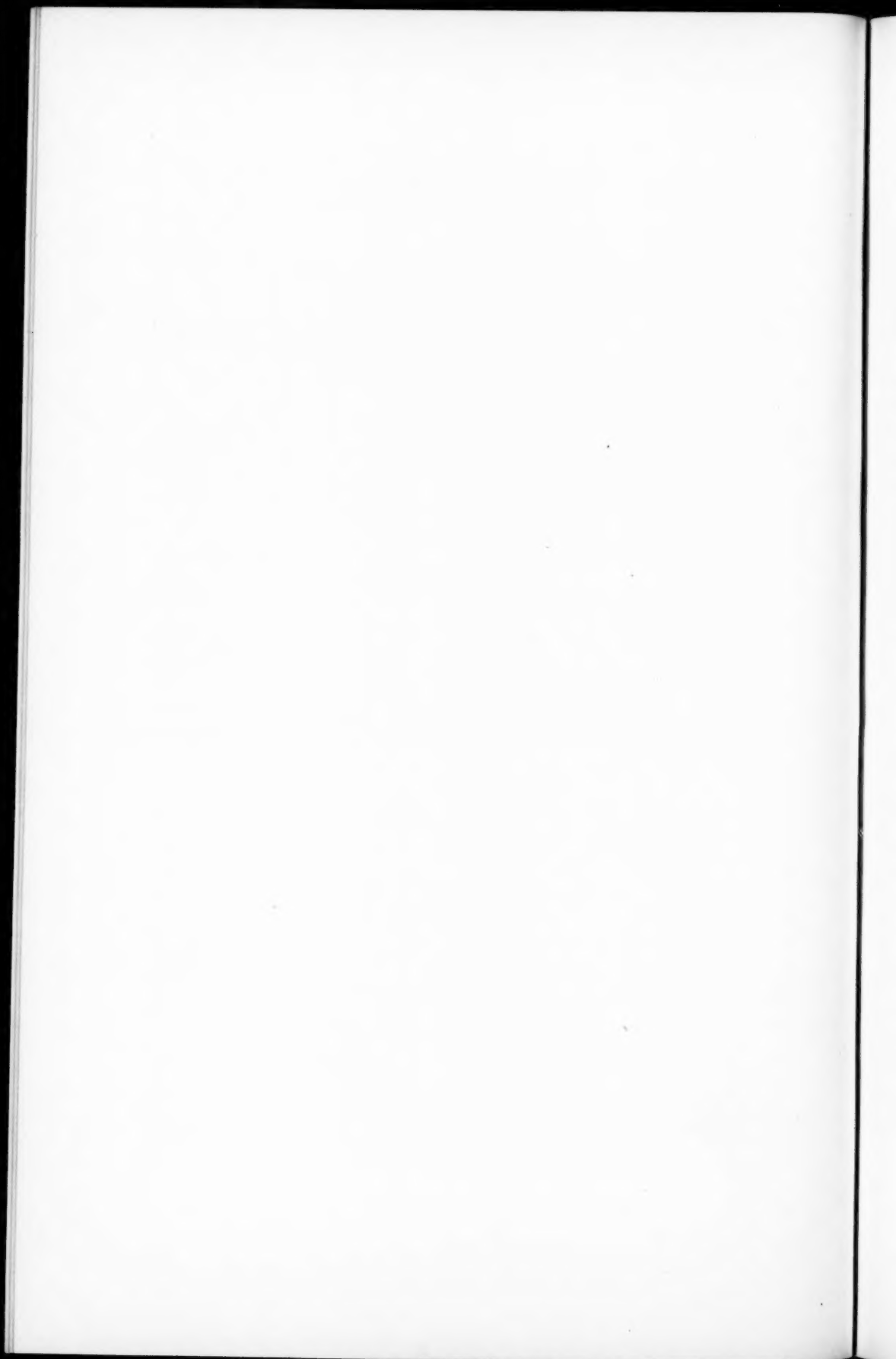
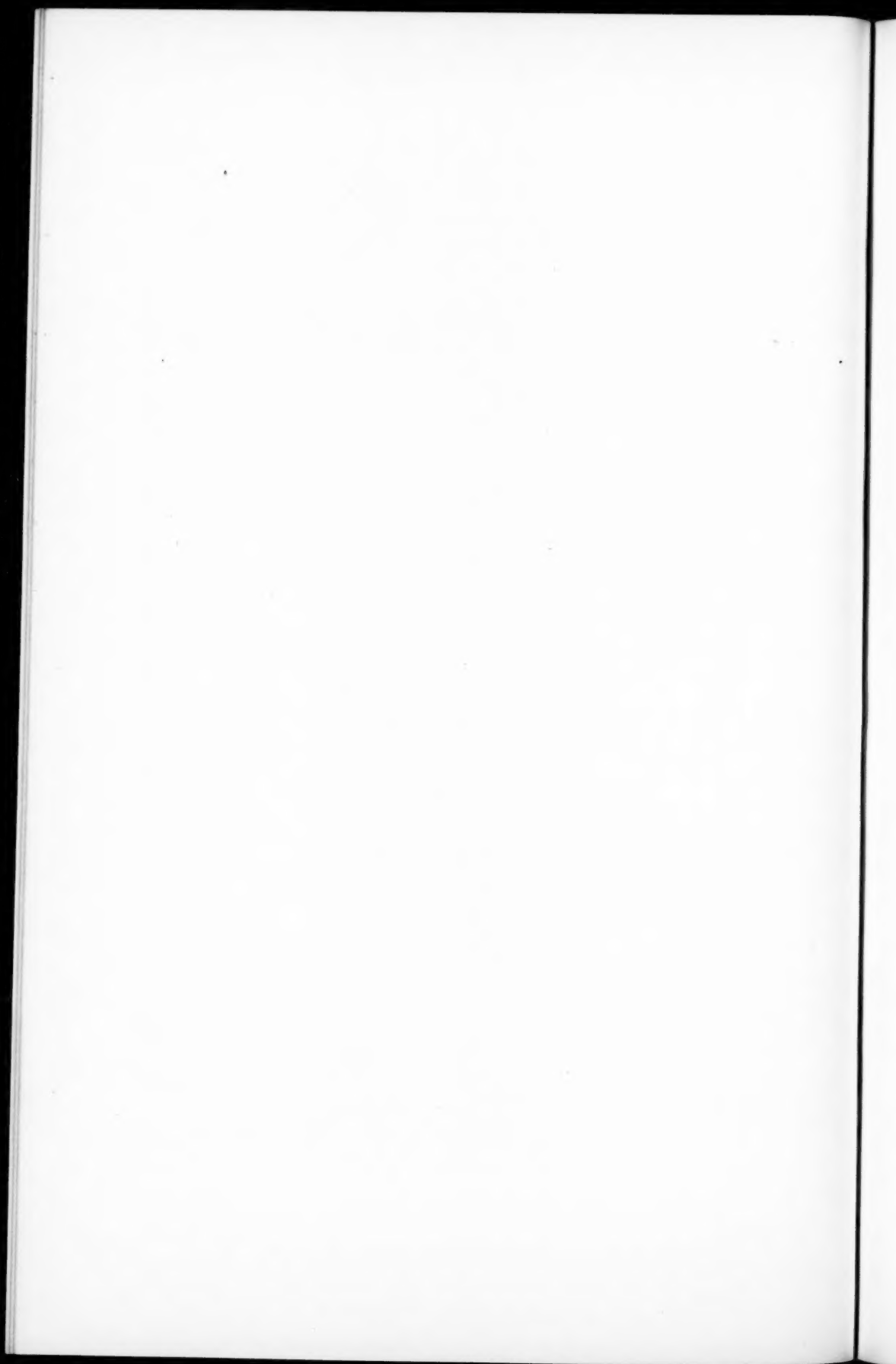




FIG. 22.—Inversion of non-reduced styloid process.



bilization has not lasted for an extraordinary length of time. In such cases of severe functional disturbance of the joint, produced by the agglutination of the fragments in a displaced position, I have repeatedly succeeded in reducing the deformity by osteotomy. In every case the functional result has been, very satisfactory.

In addition it may be urged that there is another and frequent simultaneous injury, namely, the fracture of the styloid process of the ulna, which was discovered long before Röntgen by Nélaton and Velpeau, but has often again been disputed.

The Röntgen rays bring the great old French surgeons to honor again. My own statistics show a participation of the styloid process in 31 per cent. of the cases. Kahleyss, in his classical monograph, finds a frequency of 78 per cent., which seems to me to be rather high.

In this country, especially, Pilcher, Freeman, Corson, Thomas, Don, Haughton, and Colton have contributed their admirable share to the better understanding of this condition. How important early recognition of the displacement of the broken styloid process is, may be evident from the case of a woman of thirty years, who had sustained a fracture of the carpal end of the radius, but was not skiagraphed until eight weeks after the injury, when she still suffered from a stiff, swollen wrist. The skiagraph (Fig. 22) revealed inversion of the styloid process of the ulna, which explained the intense pain caused by any effort of bending the wrist-joint. Had this condition been recognized at an early stage, a small amount of pressure would have sufficed to push the fragment into its proper position, while after the elapse of eight weeks perfect restitution could be expected only by removing the little obstacle with the chisel.

Another interesting injury is by the fracture of some of the carpal bones at first discovered by Destoit and Gallois. In realizing that the fracture of the carpal end of the radius is not only expressed by a tear, but also that it is produced by a combination of tearing, pushing, and counterpushing, it is easily comprehended why the effect of the violence is not only

confined to the radial epiphysis, but also extends either to the ulna, as described above, or is transferred upon the carpus. It has been maintained that the preference is for the semilunar bone (Gocht, Kahleyss). It seemed to me repeatedly that I had detected this injury as long as I had made a palmar exposure only; but a lateral projection showed that the shade of the adjoining carpal end had deceived me (compare errors caused by the false interpretation of the Röntgen rays, etc., *New York Medical Record*, August 25, 1900).

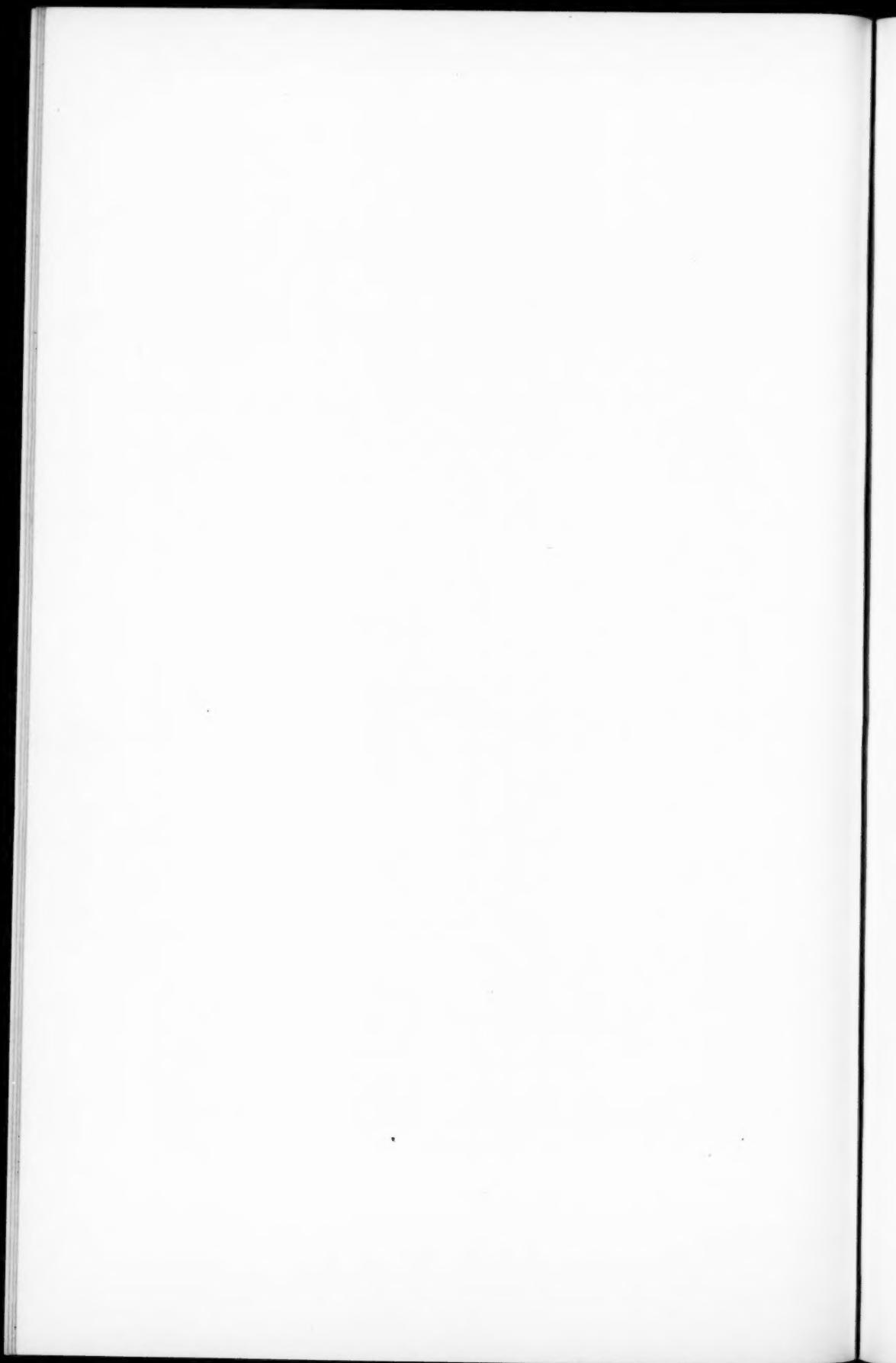
But another co-injury, namely, *transverse fracture of the scaphoid bone*, was observed by me nine times. In realizing that the scaphoid is the most important of the carpal bones articulating with the radius, it can easily be understood that the same mechanical combination following external violence, as alluded to in connection with ulnar co-injury, holds good in regard to the scaphoid bone, viz., that the pressure is continued to its arch, which has to yield. The direction of the force is straight in this instance instead of being sideways, as in ulnar co-injury. This also explains the enormous intra-articular effusion sometimes present which is responsible for the great tendency to adhesion-formation in these cases. In all the cases observed by me an extreme degree of violence was the etiological factor. Figs. 11, 17, 20, 23, and 24 illustrate such cases.

Fig. 23 illustrates a case of fracture of the carpal end of the radius, produced by great violence; the patient, a man twenty-eight years of age, having been run over by an electric car. There were neither crepitus nor any palpatory signs pointing to an injury of this kind, although the radial fragment was evidently displaced inwardly, which explains the outward bending of the ulna. The tip of the styloid process of the ulna is also broken.

The more we learned to modify our diagnosis by the Röntgen rays, the oftener we have found that the most convenient diagnosis of contusion or distortion in many instances is, in fact, nothing else but a makeshift for a fissure or fracture. Aside from the fracture of the whole styloid process of the



FIG. 23.—Fracture of carpal epiphysis of radius, combined with fracture of the tip of the styloid process of the ulna and of the scaphoid bone.



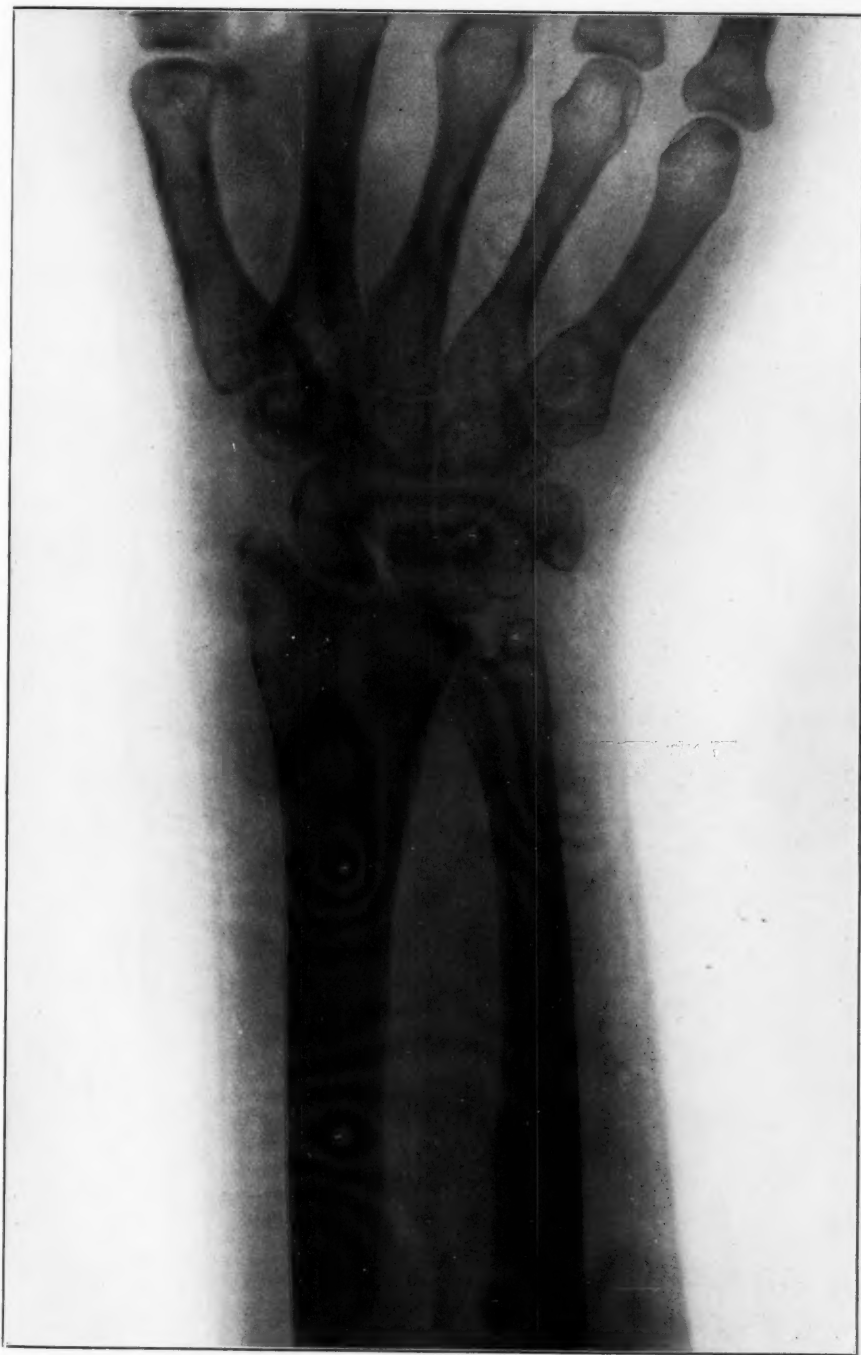


FIG. 24.—Chipping of bone at the external lower radial surface combined with fracture of the scaphoid bone.



radius itself, the stripping off of small bone portions, as it is shown by Fig. 9, is also often observed. Fig. 24 represents the wrist of a woman of twenty-four years who was struck by the fist of a strong man, and was treated for a sprain of the wrist.

The skiagraph, taken four weeks after the injury, shows a chip of bone detached from the lower external surface of the radius, and a fracture of the scaphoid bone. In such cases massage treatment is manifestly inappropriate; the treatment should be carried on after the principles of the treatment of fracture, viz., immobilization. This should be kept up at least for the first week after the injury and after the little fragments were redressed.

Such chips are sometimes not longer than the head of a pin, and if they are separated from the dorsal or palmar surface of the radius they may be not at all conspicuous on the skiagraphic plate, if taken from the palm or the dorsum, the thick shadows of the radius itself veiling them. A lateral exposure will, of course, show them distinctly. If the massage treatment, so commendable in contusion, is used in these cases, it is not surprising that the patient becomes rebellious. The Röntgen rays explain this phenomenon well. It is indeed not at all indifferent whether a simple bloody effusion or keened bone fragments are kneaded.

AN OPERATION FOR SADDLE NOSE.¹

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THE condition of saddle nose, the result of injury or disease, has commanded, for its repair, much attention from surgeons, and while most excellent results have been obtained by a variety of methods with great satisfaction to the surgeon and still greater to the patient, nevertheless I am inclined to think there is a vacancy in the list of operations which might be filled by the one to be described.

Operations on the nose for this deformity may be considered under three heads:

(1) Those which correct the deformity by implantation of bodies foreign to the human organism.

(2) Those which correct by implantation of tissues normal to the body, but taken from a distant point; either from the patient or from another individual.

(3) Those correcting the deformity through displacement and implantation of tissues taken from some part of the organ itself or from its immediate neighborhood.

The first method includes the introduction of such substances as aluminum, silver, gold, platinum, and other metals of dental composition, prepared gutta-percha, celluloid, amber, and other like materials. These are used as scaffoldings or as solid bodies moulded to the required form, and are introduced from the outside of the nose or through the mouth.

The objections are those which pertain to the implantation of foreign bodies elsewhere; subsequent erosion of metals,

¹ Read before the New York Surgical Society, March 13, 1901.

shifting of position, and ulceration are not infrequent results, and are always to be feared.

The second method has reference to the implantations of pieces of bone obtained from the patient, from another individual, or from some animal. The crest of the human tibia and the sternum of the duck may be mentioned as parts which have been used for the purpose. Operations based on this method, in my opinion, approach more nearly the ideal; for should they be successful, but slight fear of subsequent change need be felt, as the transplanted tissues have become as much a part of the normal system as they were in their original position. Unfortunately, this method is no more apt to succeed than the first.

The third method holds out hopes of immediate and permanent better results than the other two, and does not differ in principle from plastic flap operations elsewhere; the aim being to supply the defect by material which is normal, not only to the body but to the part or its immediate vicinity, and which is living tissue, having a continuous and uninterrupted blood-supply. Nearly all operations by this method, however, are made at the expense of considerable scar, and some necessitate two or more operations.

The selection of any method must depend on the conditions found in the individual case, and the operation I have to present is adapted to the less severe forms of saddle nose. As that variety is the more common, I think this operation will meet the requirements of most cases.

The principle involved is the one followed by the landscape gardener who utilizes the material at hand, and by a system of grating and equalization destroys the ugly portions by filling in hollows with matter taken from elevations.

If one examines a saddle nose with care, it is surprising how little actual loss of material exists (of course I refer to the variety under consideration). It seems more a falling together or collapse from want of support than of actual loss of quantity. Nearly the full amount of original nose is present, and the change is simply a loss of shape. By

actual measurement, the amount of loss is very slight compared to the amount of deformity.

The cast of a case which I have shows a depression of only an eighth of an inch, while the deformity gives the impression of at least twice that amount.

The operation may be described as follows:

A longitudinal incision is started in the middle line at or near the root of the nose, depending on the amount and situation of the deformity; it is carried downward towards the tip of the nose. At a variable point, depending on conditions to be mentioned hereafter, the line of incision divides, the two lines separating more or less and coming together again below the tip, forming an ellipse. This incision is carried through the skin, and the skin included in the ellipse is removed. The skin is then dissected loose for a sufficient distance on either side, especially in the region of the deformity.

The next step is to dissect up a flap composed of the subcutaneous tissue and perhaps cartilage, starting at or below the tip and raising the flap as far as the lower end of the depression, leaving it attached by a broad base at its upper part. The flap is turned upward and laid with its outer surface upon the exposed cellular tissue at the upper part of the incision, corresponding to the depression.

The flap is made thicker in the middle than at the sides or ends, the thickest part, when it is placed in position, corresponding to the most depressed part.

I think it is best not to carry the upper end of the incision too high, but, having loosened the skin at that point, to tuck the free end of the flap under it; such a course makes less scar, and union is apt to be more prompt and firmer. After raising this flap, a portion of the cartilages lying on each side of the median line of the tip is removed, the amount depending on the spread of the nostrils.

The suturing should be done with a fine small needle, preferably with horse-hair. The approximation should be

very accurate and not too tight. The stitches should be removed as soon as possible.

The quantity of skin removed in the ellipse depends on the amount of broadening of the tip and alæ. A narrow piece should be first removed, and subsequently more, if necessary.

The skin is then approximated by very fine sutures throughout the length of the incision, a figure-of-eight (8) suture being used at the tip to approximate the deeper parts, and the wound is covered by a light dressing of collodion, iodoform, and gauze.

There are a few details which may be added that will assist in insuring success. If you will observe such a case in which the deformity presented is typical of this class of cases, you will notice three things: first, the depression of the bridge; second, the lowering of the tip below the line of the septum between the nares; third, the broadening and flattening of the alæ.

If you will examine the cast taken of such a case after operation, you will see that the three deformities have been markedly corrected, and that all parts have been made proportionate and symmetrical.

The case which formed the subject of these casts was operated on by me on June 29, 1896. His deformity was the result of an accident when a boy. He was thirty-five years of age, and sought relief because of a desire to enter another branch of his profession. He was an actor, and wished to change from comedy to tragedy, but found his nose was not of proper contour for the latter.

In his case, after raising the flap of subcutaneous tissue, a wedge-shaped piece of tissue, including cartilage, was removed from the tip, and the parts at this point were approximated by a figure-of-eight (8) suture of horse-hair, thus holding the divided structures in close apposition throughout their depth.

Many modifications of the method will suggest themselves to the operator, and be made to fit the case.

I would say that the prominence noticed on the ridge

of the cast after operation is in great part scab composed of iodoform and serum. The patient was anxious to leave the city, and the cast was taken about five or six days after operation. The immediate result, however, could be seen. The subsequent result, I regret to say, I cannot give you, as I have been unable to trace the patient. The same is true of two other patients upon whom I have performed the same operation.

The advantages of this operation, in my opinion, are as follows:

(1) The absence of foreign bodies, with the consequent annoyance and dangers accompanying their use.

(2) Correction made with living attached tissue having its own blood-supply.

(3) Ability to correct at the same time minor deformities.

(4) The field of operation in sight.

(5) A minimum of scar.

The disadvantage is that the operation is performed externally with a resulting scar. This, I think, is slight, and the scar is hardly to be noticed, especially if care is exercised in adjustment and suturing.

THE ARTIFICIAL PRODUCTION OF CONNECTIVE TISSUE BY MEANS OF INJECTION OF AGAR-AGAR.

By SIMON PENDLETON KRAMER, M.D.,

OF CINCINNATI.

IN the search for a substance with which to tampon the thoracic cavity in cases of penetrating wounds of the chest, it seemed for many reasons desirable to use something which might be introduced in a fluid state, but which would solidify at the temperature of the body. With this end in view, experiments were made with neutral 4 per cent. solutions of agar-agar in physiological salt solution.

One side of the chest in a number of rabbits was filled with this melted agar jelly by injection at a temperature of 42° C. The animals were killed after a varying number of days.

In the chest of an animal killed forty-eight hours after the injection there was found a mass, insoluble in boiling water, that had lost the gelatinous appearance of agar jelly, that resembled an ante-mortem heart-clot in appearance more than anything else. On hardening a piece of the mass and examining a section, it was found that the jelly had become honeycombed with small round cells.

Fig. 1 is a photograph of such a section taken with a two-thirds-inch objective and an ocular magnifying six times.

Fig. 2 is a photograph of the same section taken with a one-twelfth-inch oil immersion objective.

A section taken from a mass obtained from an animal killed after seven days shows that this infiltration has increased so that the mass is more densely cellular. Many of the cells, however, are smaller, and do not stain so well, showing a beginning degeneration.

Fig. 3 is a photograph of such a section taken with the same lenses as Fig. 2.

Fig. 4 is a photograph of the same section taken with a one-twelfth-inch oil immersion objective. After twelve days the cellular infiltration is more dense, and there are formed adhesions between the mass and the sides of the chest and lung.

Fig. 5 is a photograph of one side of the opened thorax of a rabbit killed twelve days after the injection of twenty cubic centimetres of agar-agar jelly into the right side of the chest. The outer wall of the thorax has been removed, showing the lung at L and the mass spoken of at A. The adhesions between the mass and the wall of the chest may be seen. A piece of the mass was removed at the point indicated by the arrow, *b*, hardened, and a section examined.

Fig. 6 is a photograph of such a section. The photograph shows a dense infiltration of small round cells. The left side represents that part of the section which in the animal was nearest the mass. The right side was nearest the chest wall. It will be found that the cells in the first portion are smaller and stain badly. They are the first cells that have invaded the jelly. The cells on the part of the section nearest the chest wall, pictured in the right portion of the photograph, stain very readily. Many fibroblasts are seen, and new blood-vessels are beginning to be formed by a pushing in of buds springing from vessels of the pleura and carried in the bands of adhesions between the mass and the pleura. In other words, the mass of agar jelly at first infiltrated by small round cells is being replaced by vascularized connective tissue.

The process outlined here continues until in from thirty to forty days the entire mass has become replaced by a new reticular connective tissue with a plenteous formation of new blood-vessels.

Fig. 7 is a photograph of a section obtained from an animal killed thirty days after the injection. A newly formed blood-vessel can be plainly seen at A. The photograph was taken with a one-fifth-inch objective.

The process by which connective tissue replaces the agar

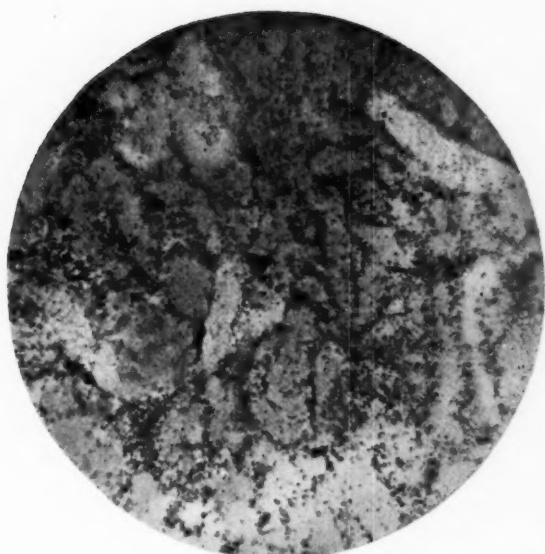


FIG. 1.

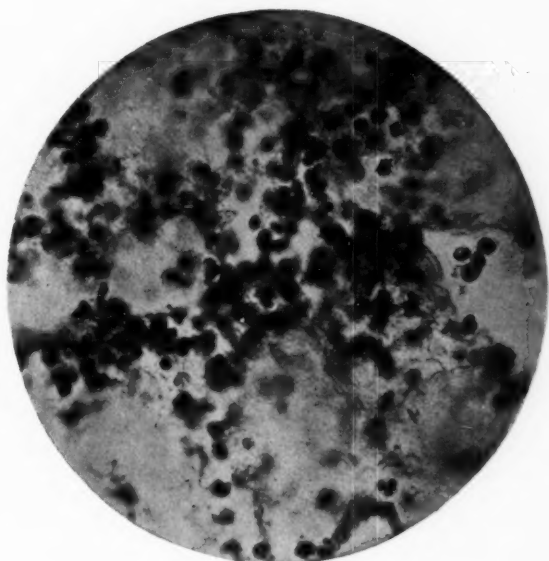
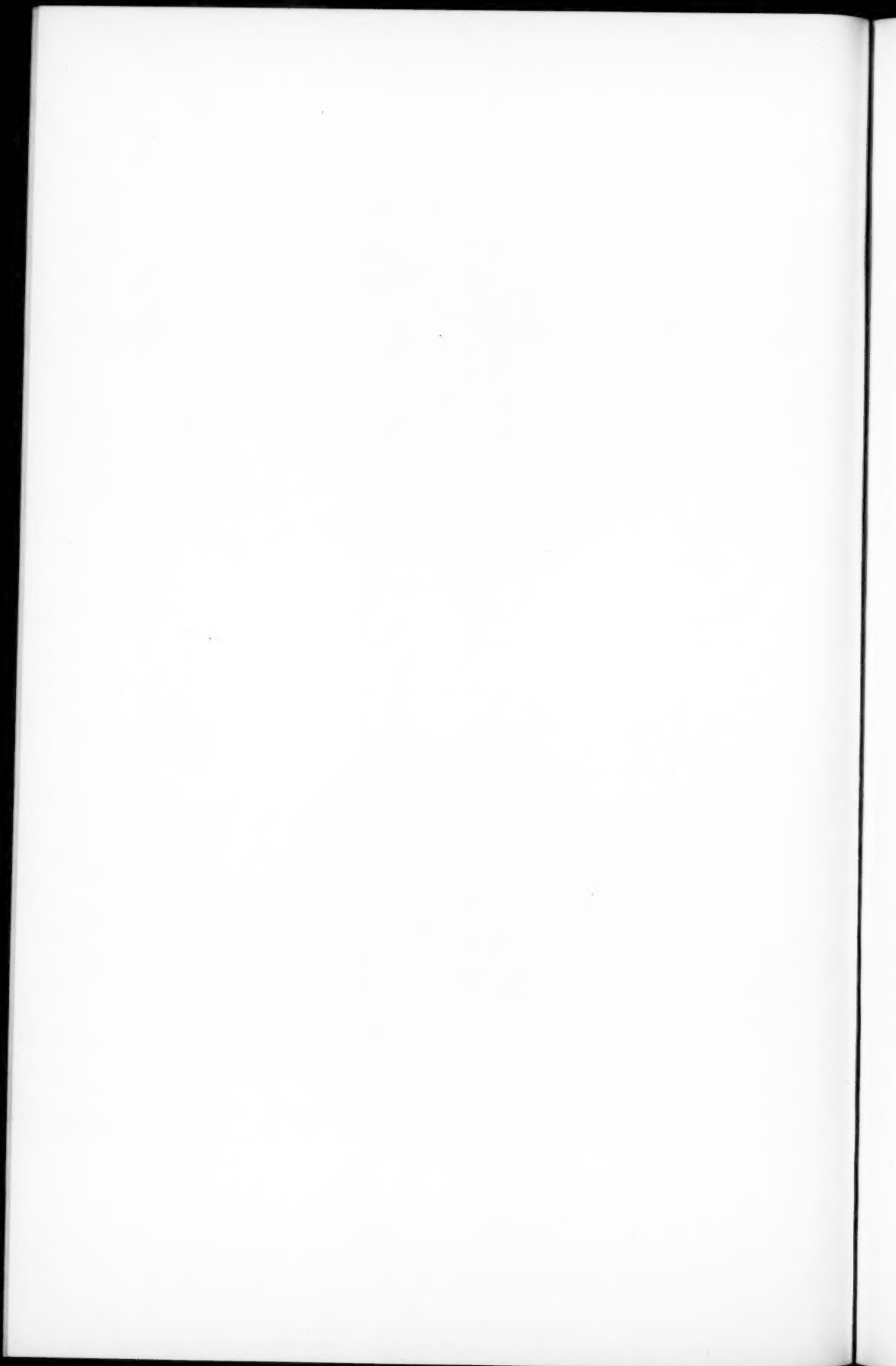


FIG. 2.



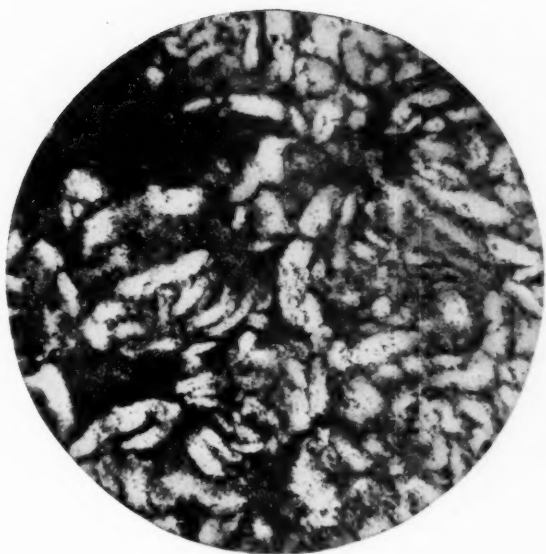


FIG. 3.

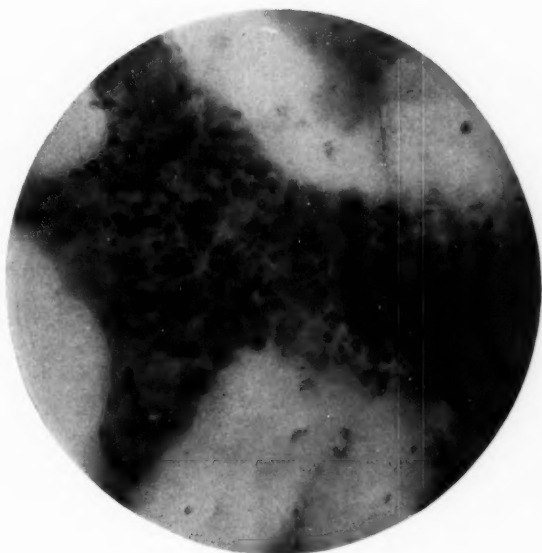
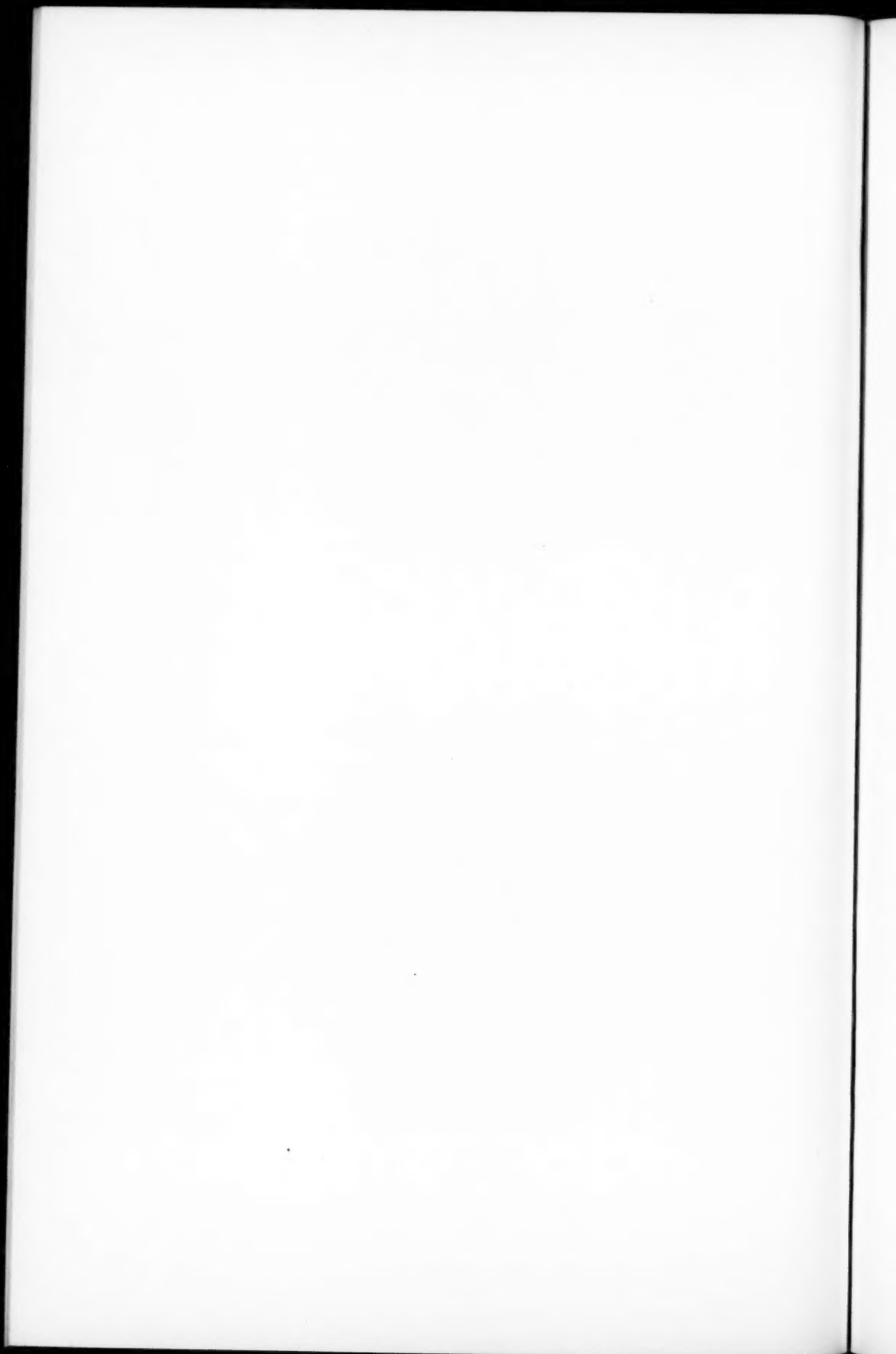


FIG. 4.



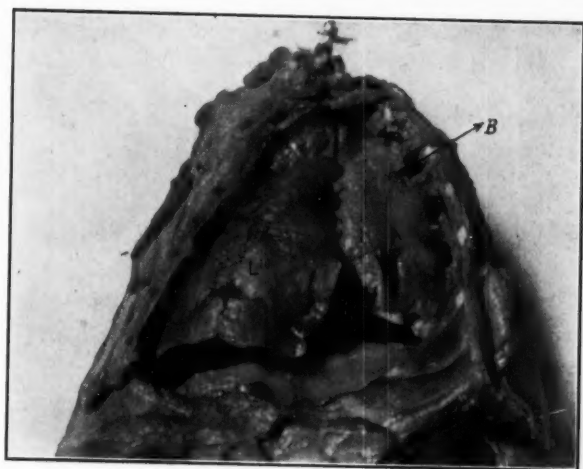


FIG. 5.



FIG. 6.

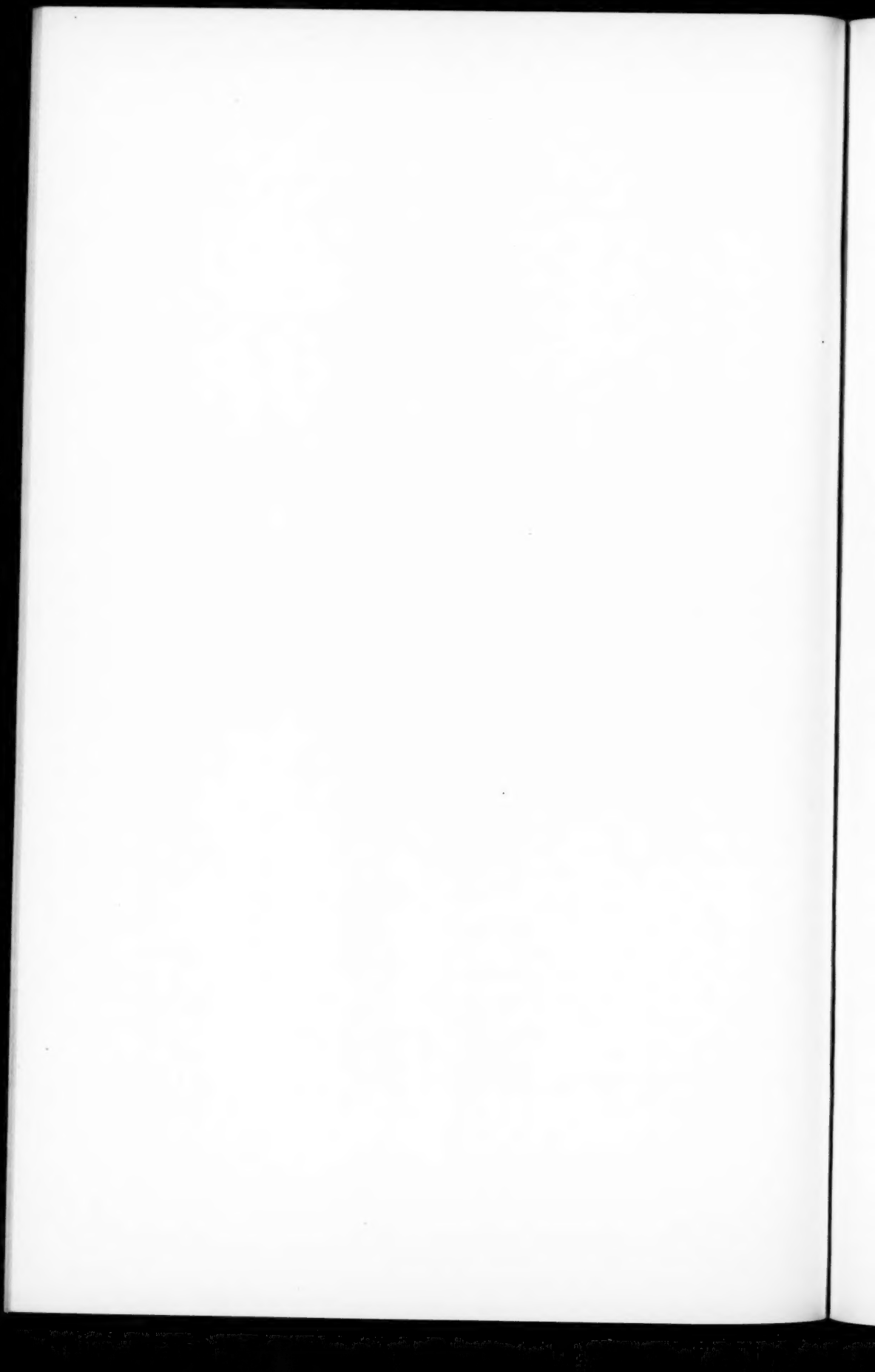
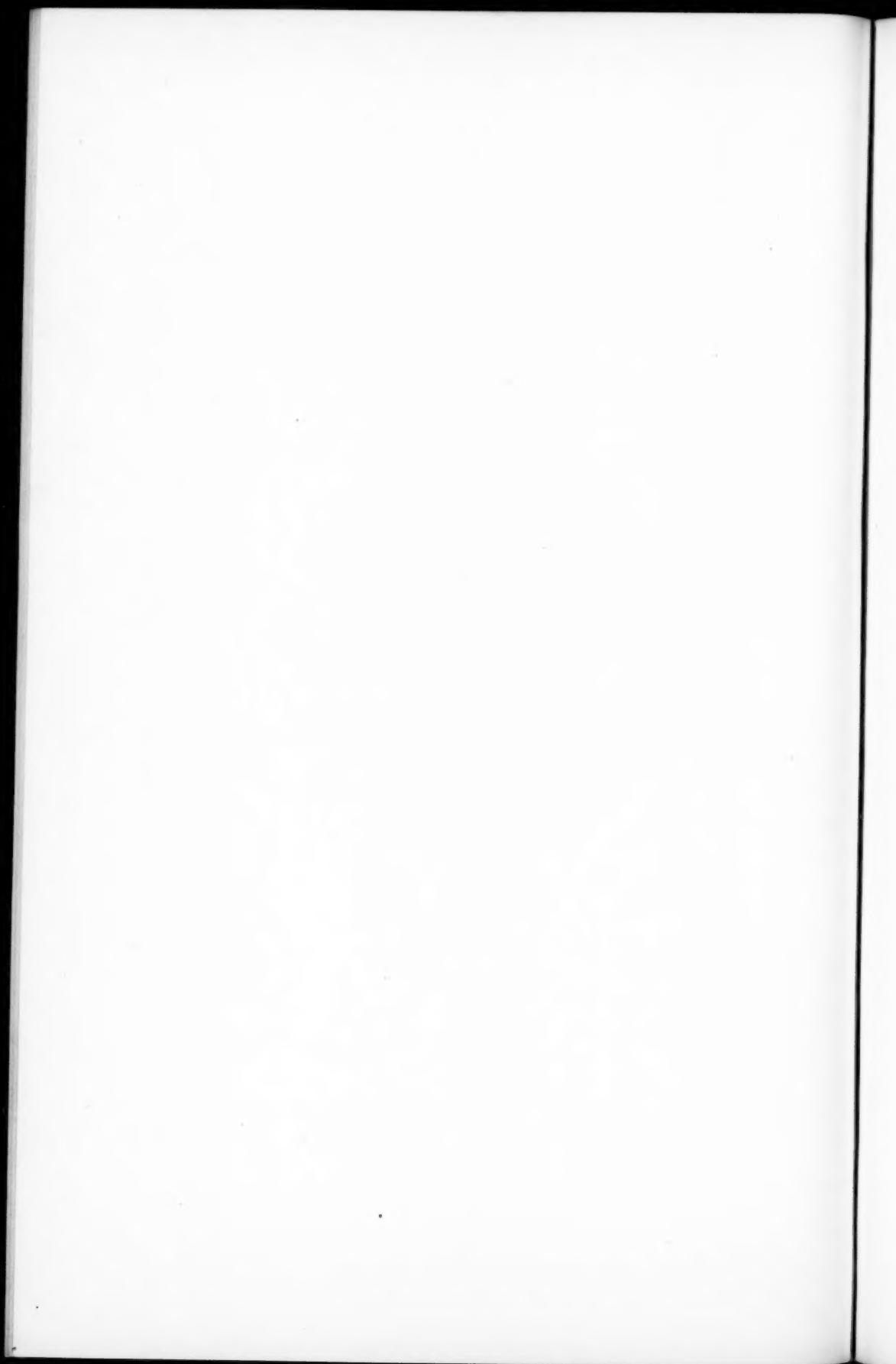




FIG. 7.



jelly is precisely the same as that by which a thrombus becomes "organized." The agar-agar represents the blood-clot and the sides of the pleural cavity represent the walls of the blood-vessels, from which sprout the newly formed blood-vessels which are to vascularize the new connective tissue. The agar-agar acts as a trellis-work to support the new tissue and to direct its growth. The jelly being a bland mass and becoming semi-solid at the temperature of the body, and therefore not readily diffusible, is gradually broken up and removed by wandering cells and phagocytes, as is the case with the blood-clot.

This "organization" of the agar-agar jelly takes place equally well when injected subcutaneously. Of course, the experiments must be made with sterile jelly and under aseptic precautions. An addition of formaldehyde in the ratio of 1 to 2000 will insure the aseptic condition of the mass, and will not interfere with the formation of connective tissue. The jelly may be injected at a temperature of 40° C., provided the syringes have been previously warmed.

It is hoped that these experiments may prove to be of some surgical utility. It is very often desirable to produce an artificial growth of connective tissue by means of an injection.

In several cases of inguinal hernia the sac and canal have been filled with the material, which has become organized and has cured the defect. The permanency of the cure will only be determined by the lapse of time and by further experiment.

In the treatment of aneurism, hydrocele, bone-cavities, tubercular cavities, etc., we may hope for benefit.

For the testing of these practical applications of the results of these experiments, the author is not so situated as to have abundant opportunity, and this is his excuse for this early publication.

AN OPERATION FOR THE RADICAL CURE OF UMBILICAL HERNIA.¹

By WILLIAM J. MAYO, M.D.,

OF ROCHESTER, MINNESOTA,

SURGEON TO ST. MARY'S HOSPITAL.

THE results of operations for the radical cure of umbilical herniæ in adults have not been encouraging. These patients are usually obese, with attenuated abdominal muscles, and the thin, rigid character of the ring does not offer mechanical conditions advantageous to lasting union.

The principles of closure have been the same as after an ordinary abdominal section, the object being to split the fascia at the ring margins laterally, until the recti muscles are reached, and then by a series of buried sutures to reconstruct the abdominal wall in layers. The defect in this method is the natural separation of the recti muscles at the level of the umbilicus. Below this point the muscular structures are practically in contact, but above there is from one-fourth to three-fourths of an inch separation. To bring the recti together in this locality amounts to a muscle transplantation. In a small hernia this muscular approximation is not difficult, but in the larger openings, an inch or more in diameter, it is impracticable; and so far as I have been able to judge, the attenuated muscles, when secured, are not of great value as retentive agents in this variety of hernia. In very corpulent subjects the muscular separation is greater. If such a patient, lying on the back, be directed to rise, bringing into play the recti muscles, the lateral deviation at the level of the umbilicus is easily shown, and in the majority of cases demonstrates the impossibility of bringing them firmly into median apposition.

¹ Read before the American Surgical Association, May 9, 1901.

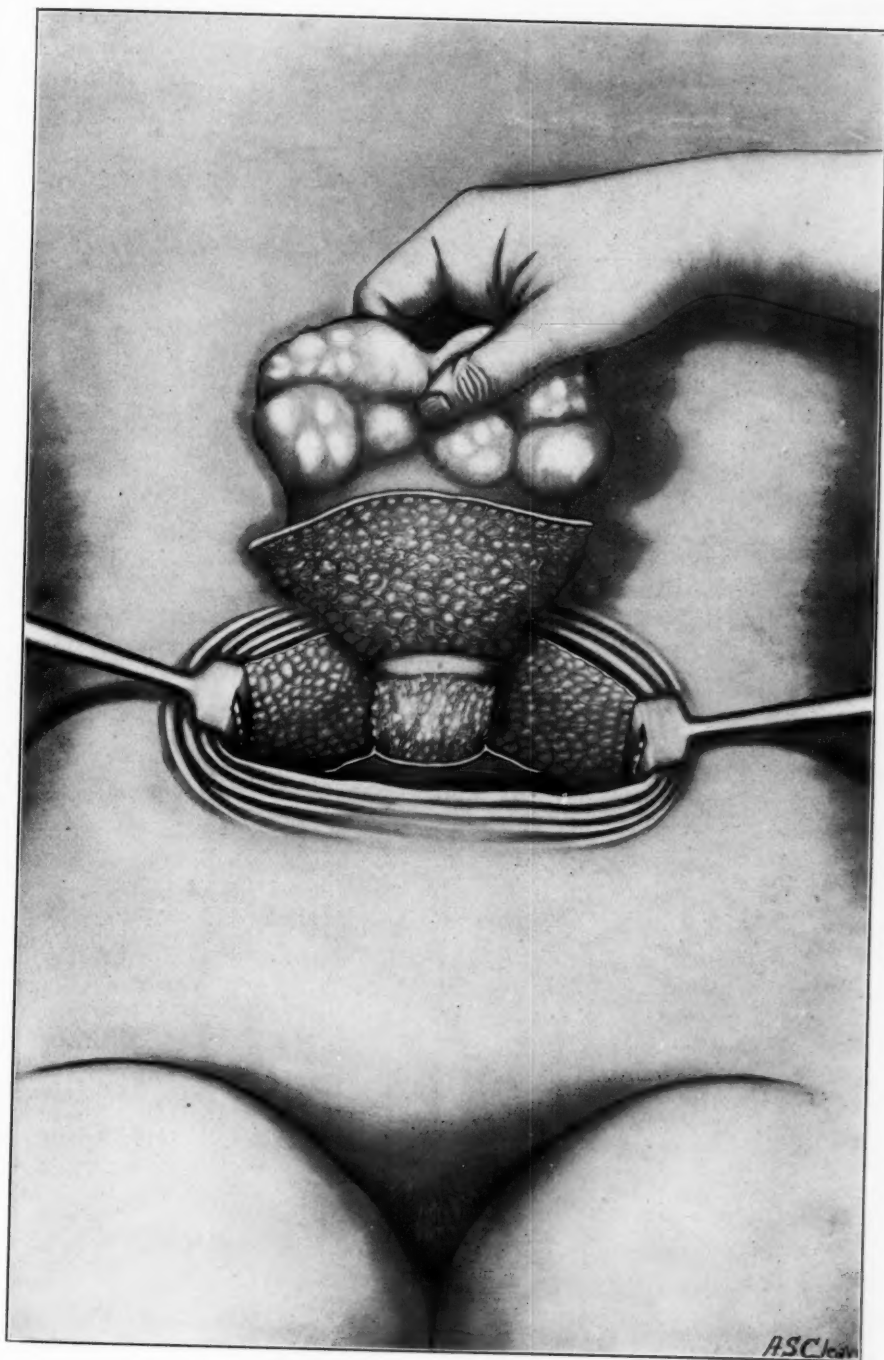
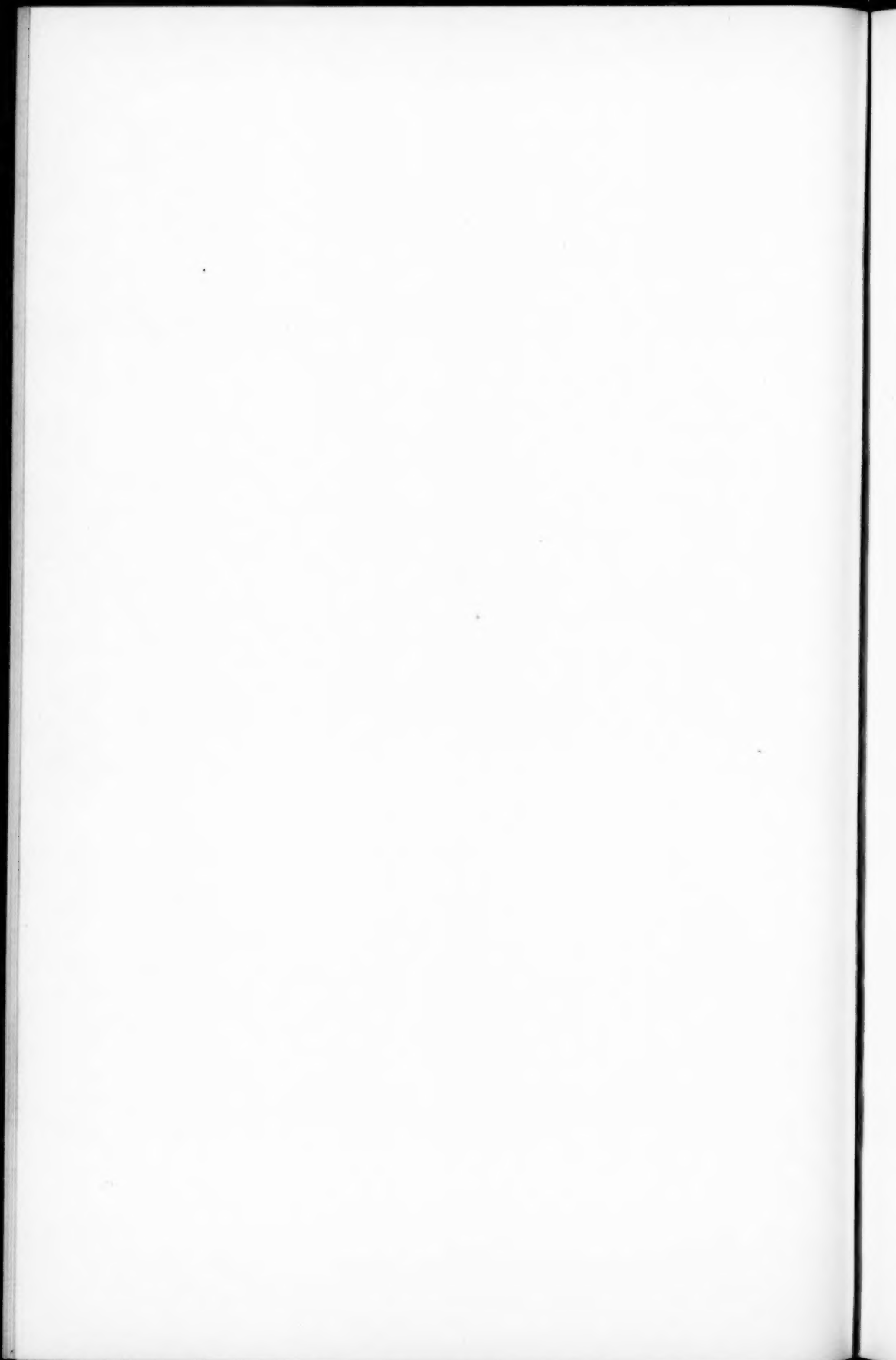


FIG. 1.—Showing exposure of hernia and lateral incisions.



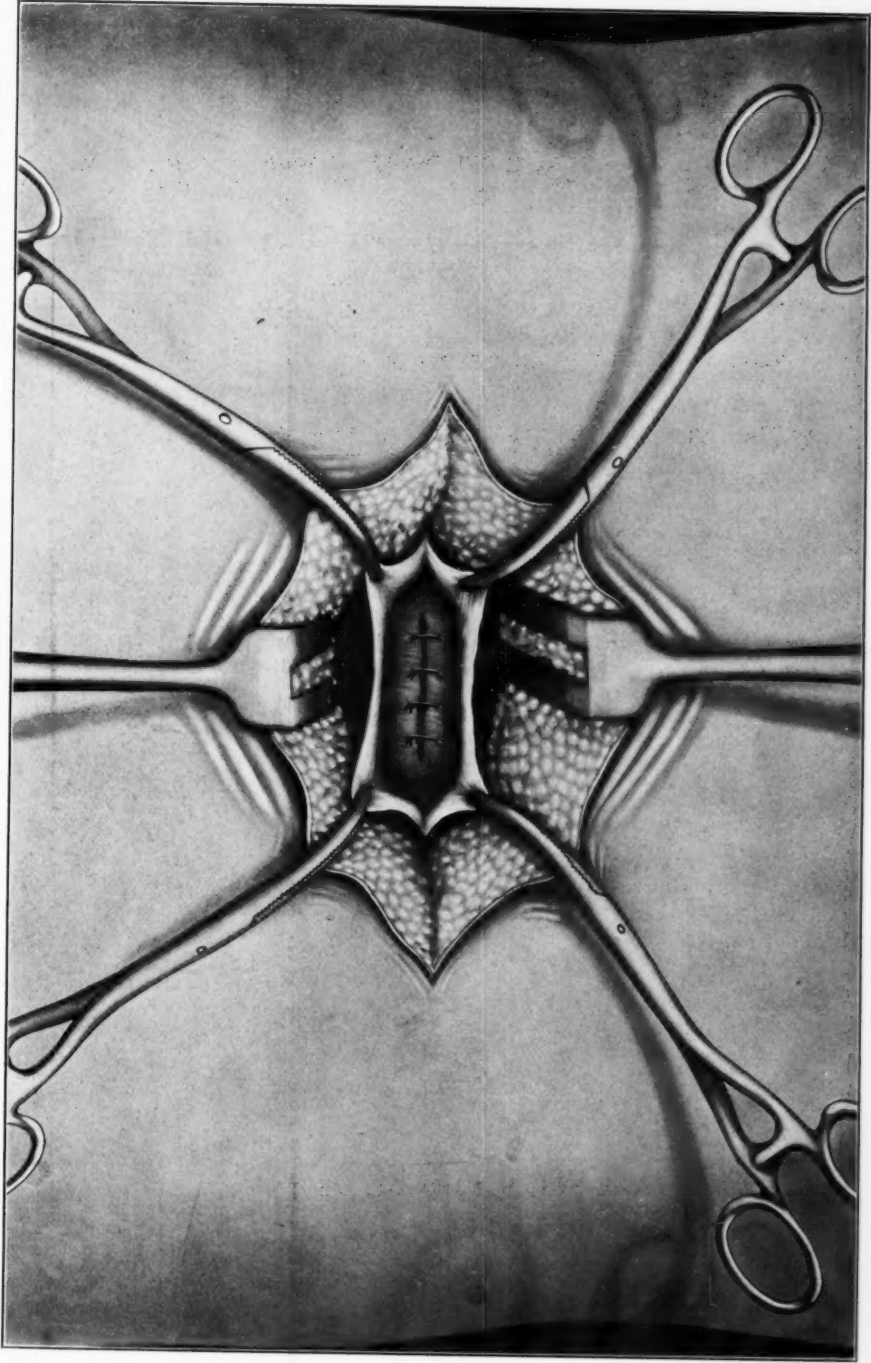
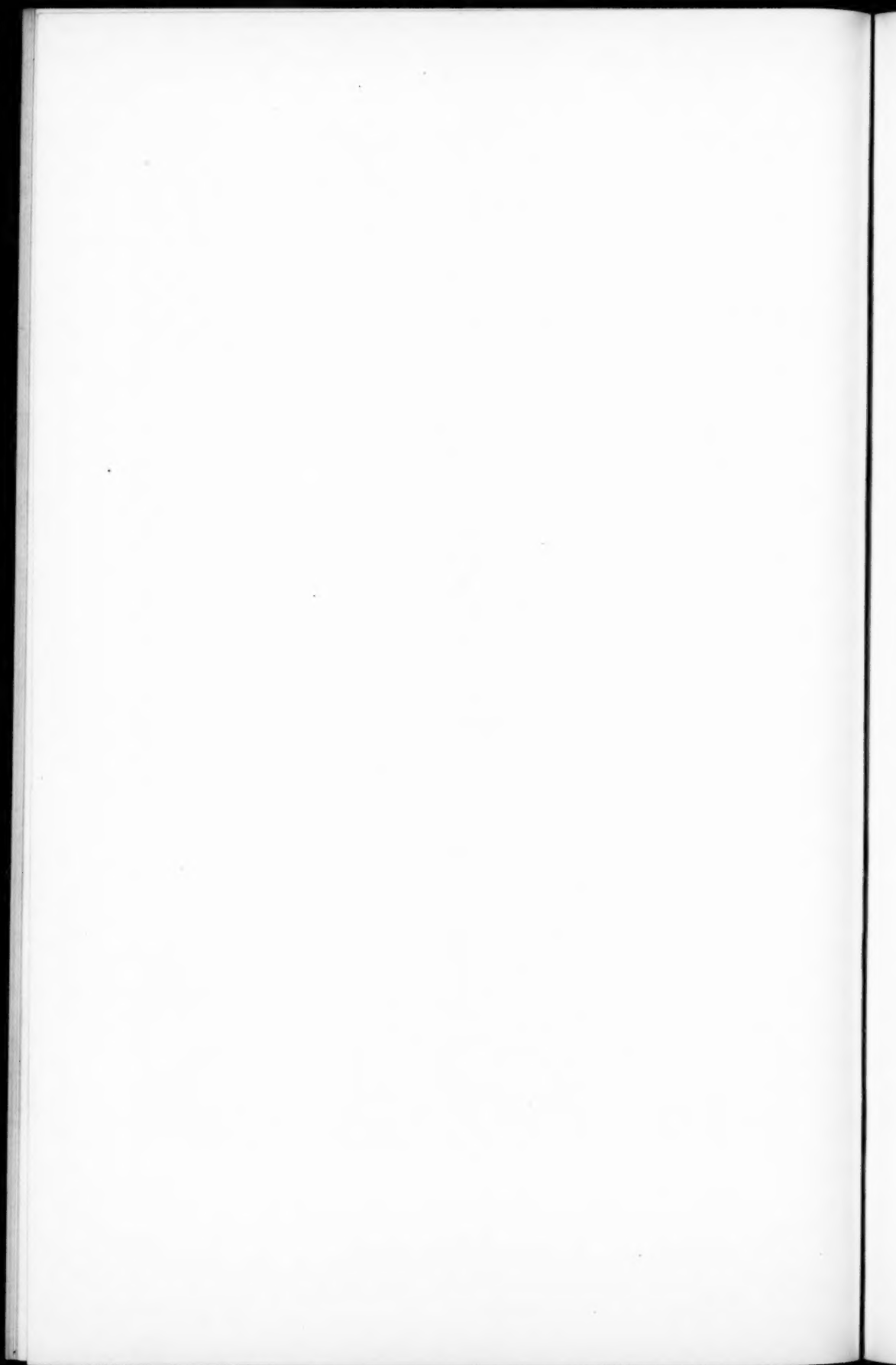


FIG. 2.—Peritoneum sutured.



Louis Championnière, after making a plea for operation in the acquired umbilical hernia of adults, well says that, although the operation frequently fails, the relapse is less uncomfortable to the patient, and has less danger of strangulation than the original hernia. This is especially true of relapses after division of the umbilical ring; the return partakes more of the nature of a ventral hernia; the internal opening being nearly, if not quite, the diameter of the protrusion. The late Grieg Smith (*ANNALS OF SURGERY*, 1895) directed that the incision should be made over the thinnest part of the umbilical sac, and this advice seems to have been generally adopted.

Ransohoff, in a practical paper (*Medical Record*, 1897), calls attention to the loss of time in dissecting down through one of these protrusions filled with adherent viscera, in danger constantly of wounding important structures, and lays down the principle that the incision should always be made into the free abdominal cavity at the neck of the hernia. This at once allows an inspection of its contents and return of intestinal coils, if present. The adherent omentum can be ligated at the internal opening, saving both time and trouble. In strangulated conditions, as pointed out by Barton, the knuckle of pinched intestine is usually in the centre of the adherent omentum, and with this form of incision the operator is in no danger of injuring the bowel. Ransohoff used silver wire in his reported cases as permanent sutures, and we have followed the same plan. Silver wire buried in bone and aponeurosis seldom gives trouble, because it lies in fixed tissues; although in movable structures, like muscle, atrophy necrosis may occur and necessitate its removal. Wheaton (*St. Paul Medical Journal*, December, 1900) advocates operation in the larger varieties of umbilical hernia on account of the extreme disability which it causes, and in this class of cases brings up the question as to the return of the contents of large hernias, especially when they have been irreducible for more than two years. In this time, he says, "The extruded viscera has lost the right of habitation," and recommends that before operation the patient

be kept in bed for several weeks, and means taken to reduce the body weight. We have followed this method, and after removal of sufficient omentum have seldom had trouble in returning the hernial contents.

In a paper read before the Academy of Railway Surgeons, October 4, 1898, and published in the *ANNALS OF SURGERY* for January, 1899, I called attention to the impracticability of covering in the defect, left by excision of the larger umbilical hernia, with muscle, and advocated the overlapping of the aponeurotic structures which were already at hand, securing a wide area of adhesions in place of edge to edge union. This method we had then employed in five cases; in three the overlapping was from side to side, and in two from above downward. Extensive lateral incisions to find sufficient muscle to make the routine operation described by surgical writers compelled us, as a matter of necessity, to overlap from above downward, and, to our satisfaction, we found the parts came together with less tension than when drawn laterally, and time proved that the strength of union was as lasting.

The first of these overlapping operations was done in 1895. We have now made this operation nineteen times, ten times overlapping from side to side and nine times from above downward. The larger openings have usually been more easily closed by the latter method. The principle employed is not unlike the Championnière operation for the radical cure of inguinal hernia. In Championnière's method the external oblique is overlapped in a similar manner to the operation described, and Championnière's results in 800 cases have not been excelled.

The method of radial cure of inguinal hernia suggested by E. W. Andrews also depends upon the overlapping of the fascia of the external oblique for its success.

The umbilical operation is performed as follows:

(1) Transverse elliptical incisions are made surrounding the umbilicus and hernia; this is deepened to the base of the hernial protrusion.

(2) The surfaces of the aponeurotic structures are care-

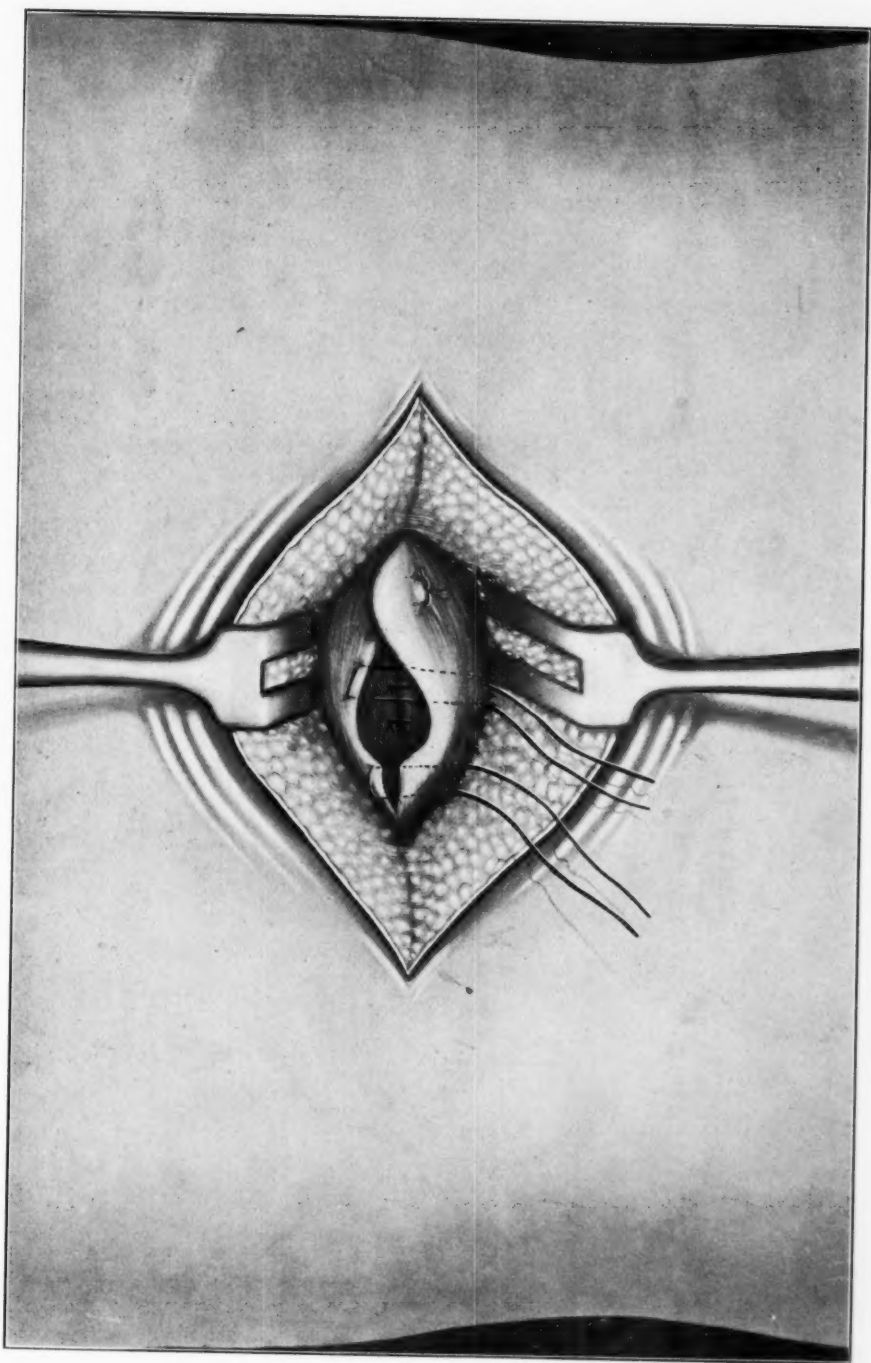
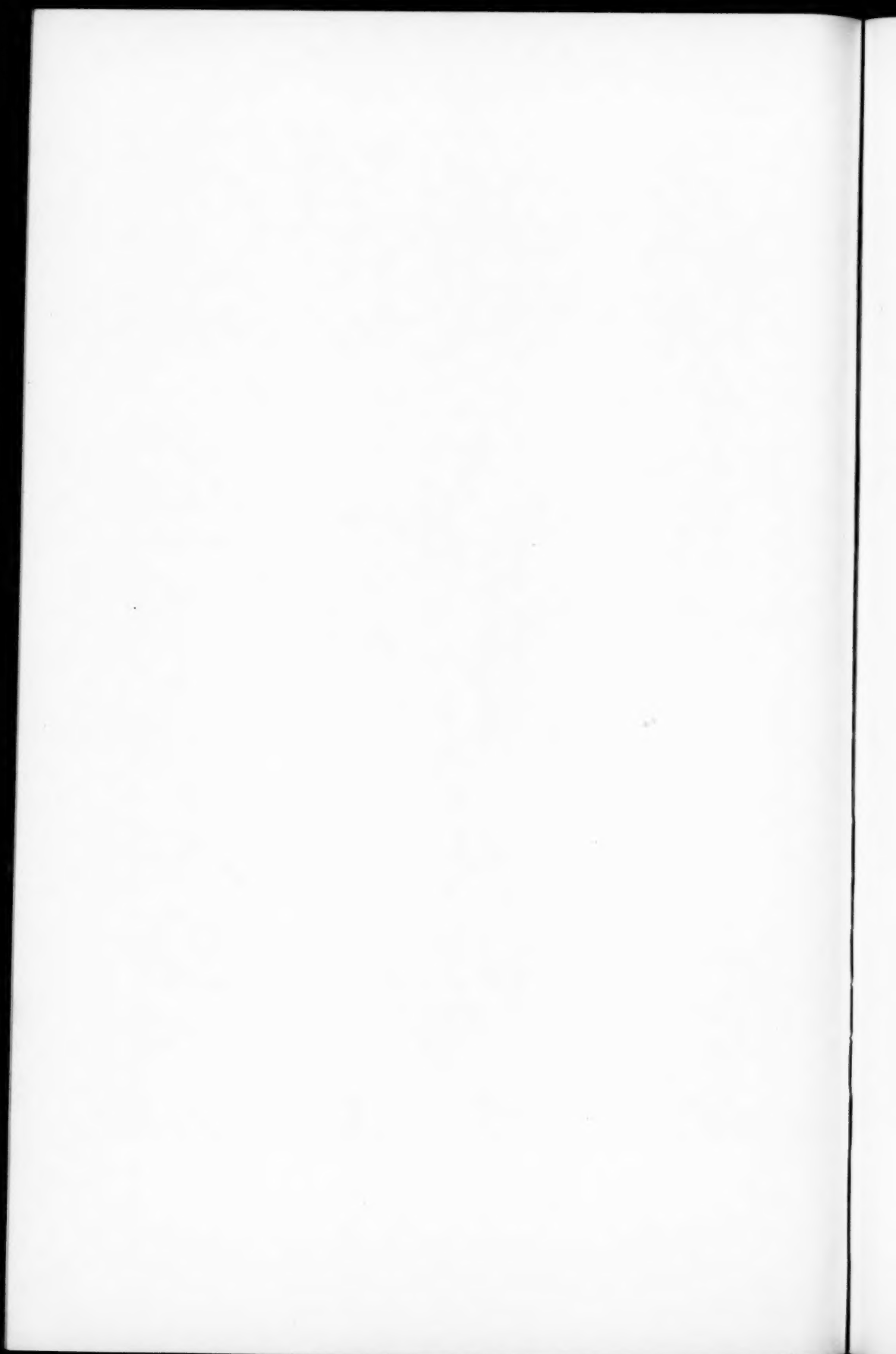


FIG. 3.—Aponeurosis sutured.



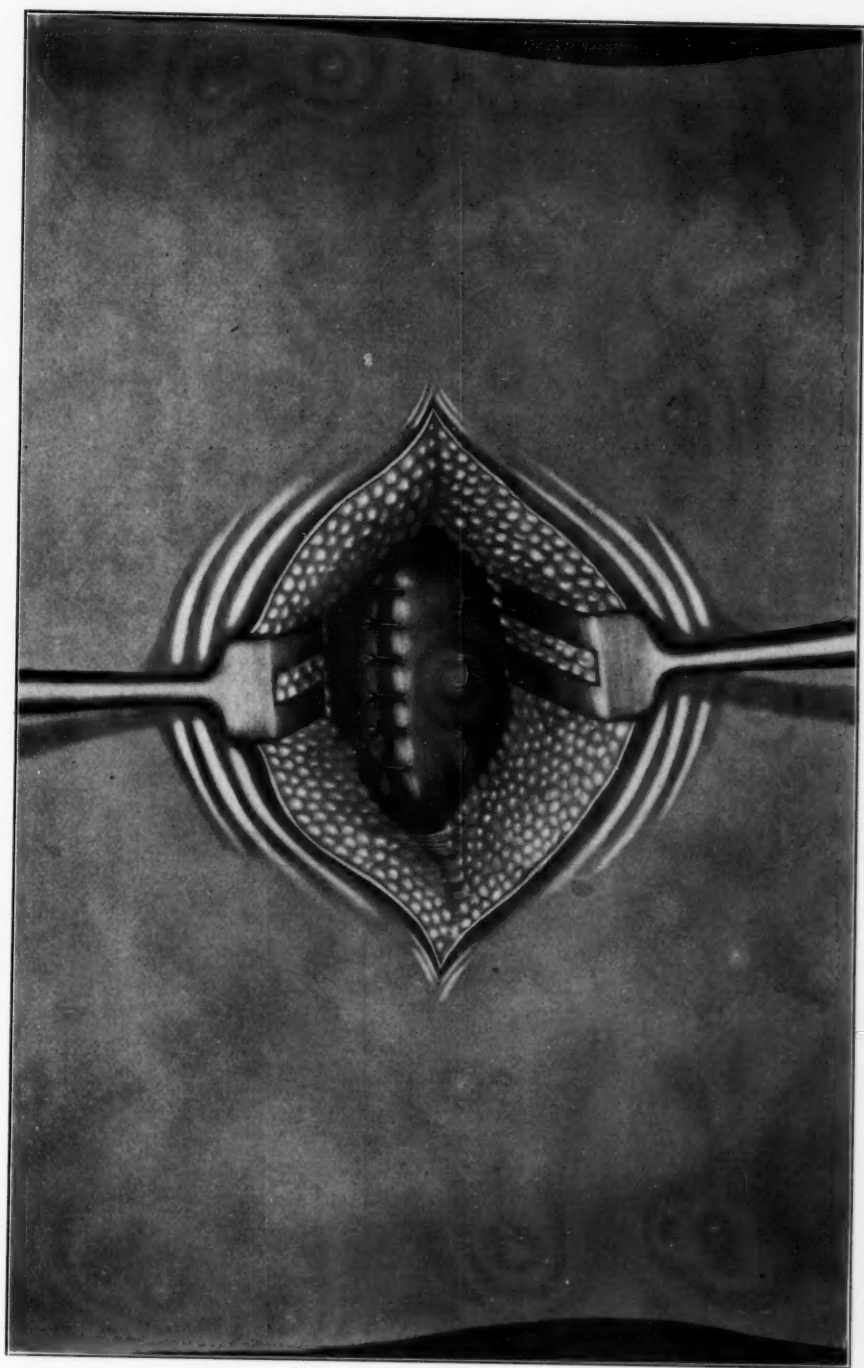
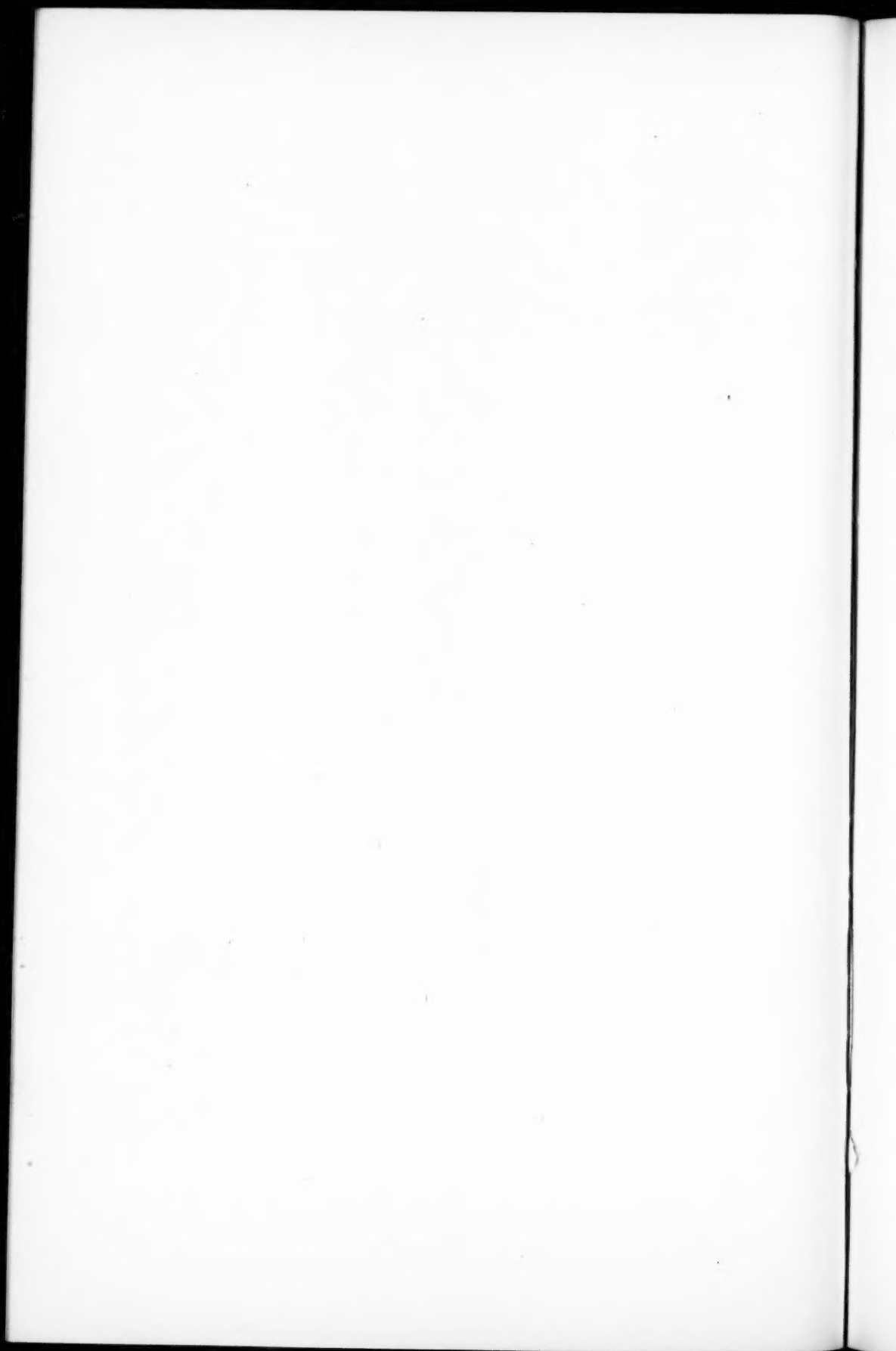


Fig. 4.—Aponeurosis sutured second time with gut sutures.



fully cleared an inch and a half in all directions from the neck of the sac.

(3) The fibrous and peritoneal coverings of the hernia are divided in a circular manner at the neck, exposing its contents. If intestinal viscera are present, the adhesions are separated and restitution made. The contained omentum is ligated and removed with the entire sac of the hernia.

(4) With forceps the margins of the ring are grasped and approximated; whichever way the overlapping is more easy of accomplishment, suggests the direction of closure. The figures show the overlapping as done from above downward.

(5) For this approximation an incision is made through the aponeurotic and peritoneal structures of the ring extending one inch or more transversely to each side, and the peritoneum is separated from the under surface of the upper of the two flaps thus formed.

(6) Beginning from one to one and one-half inches above the margin of the upper flap, three to four silver-wire mattress sutures are introduced, the loop firmly grasping the upper margin of the lower flap; sufficient traction is made on these sutures to enable peritoneal approximation with running suture of catgut. The mattress sutures are then drawn into position, sliding the entire lower flap into the pocket previously formed between the aponeurosis and the peritoneum above.

(7) The free margin of the upper flap is fixed by catgut sutures to the surface of the aponeurosis below, and the superficial incision closed in the usual manner. The lateral approximation is carried out by sliding one side under the other in the same manner. In the larger herniæ the incision through the fibrous coverings of the sac may be made somewhat above the base, thereby increasing the amount of tissue to be used in the overlapping process. In only one case were we unable to satisfactorily close the opening as described, on account of the large size of the umbilical ring. In this case less than one-half an inch of overlapping was secured, and that under great tension; the result was a boat-shaped stretching of the united parts, but the symptomatic cure was excellent. The results

in the other cases, so far as known, have been good, although many of them are too recent to be called cured, and possibly relapses will occur.

Piccoli (*Centralblatt für klinische Chirurgie*, January 13, 1900) reports a case successfully operated upon in August, 1899, after a similar plan, and refers to a case reported by Bonomo, operated upon December 9, 1899, with a favorable result. J. A. Blake (Medical Association of Greater New York, January 14, 1901) reports several cases operated upon by the same method during the year 1900, and refers to an article by Sapiejko (*Rev. de Chir.*, 1900, No. 2, p. 240) in which an identical operation is described. It is evident that a number of operators have independently worked out the idea, all reporting favorable results.

SARCOMA OF THE WALL OF THE THORAX.

SUCCESSFUL EXCISION OF A PART OF THREE RIBS AND A
PORTION OF THE DIAPHRAGM.

By CHARLES B. PORTER, M.D.,

OF BOSTON, MASS.,

PROFESSOR OF CLINICAL SURGERY IN HARVARD UNIVERSITY; SURGEON MASSACHUSETTS GENERAL HOSPITAL.

THE following case is reported as a contribution to the surgery of the chest.

The patient, H. J. D., male, forty-one years old, occupation, pressman, born in Boston, entered the Massachusetts General Hospital, January 16, 1900.

The previous and family histories are of no importance.

The present illness began about three and one-half months ago. At that time he felt a stitch-like pain in the right side, localized in the anterior axillary line at the level of the eighth rib. The pain was increased on deep inspiration, and became especially severe when physical activity caused increased respiratory movements.

Three weeks later the patient first noticed a swelling at the seat of the pain. The tumor was hard at first, but became softer as it increased in size. At no time has the growth been tender to ordinary pressure.

Coincident with the growth the patient has been losing strength and weight. During the past three months he has lost eighteen pounds.

Physical Examination.—Well developed and nourished man; heart and lungs negative.

On the right thoracic wall is a dome-shaped tumor the size of one-half a medium-sized cocoanut. (Fig. 1.) The centre of

the tumor is at the level of the eighth rib in the anterior axillary line. The tumor moves with respiration.

The growth is not adherent to the skin, but is firmly attached to the ribs. It is soft on palpation, suggesting semi-fluid contents. On deep pressure the tumor is tender. The chest was examined by Dr. F. C. Shattuck, who found no abnormal respiratory sounds.

In order to determine if the process was of tubercular origin, the patient was subjected to the tuberculin test, with a negative result. Fifteen minims of a one per cent. solution of tuberculin were injected deep into the thigh. X-ray of the chest was negative.

Blood Examination.—Reds, 5,836,000; whites, 14,000; hæmoglobin, 65 per cent. Urine negative.

Operation.—A preliminary tracheotomy was done with the patient in the sitting position. The object of doing a tracheotomy was to be ready to inflate the lung by means of a rubber tube passed through the tracheal opening, if necessary. Other operators have found this expedient necessary where sudden shock was induced by collapse of the lung.

The patient was then placed upon the operating-table, with the right side elevated and the right arm extended over the head. A curved incision through the skin was then made, starting in the midaxillary line at the fourth rib; it was then continued downward to the infracostal edge of the ribs, thence forward to the edge of the rectus.

A flap thus outlined was turned up from below. On dissecting away the subcutaneous fat the growth was found to be encapsulated. The capsule being quickly exposed appeared greenish black, rough, and elastic to pressure. On opening the capsule there was a gush of blood, which continued, except when pressure with gauze was used.

Although many clamps were put on, the hæmorrhage was still rapid. It was evident that the tumor could not be dissected from the ribs on account of this uncontrollable hæmorrhage. By means of a large spoon curette the entire mass was rapidly scraped away down to the ribs. The bleeding was now partially controlled by many clamps and pressure with gauze.

The reason for this type of hæmorrhage will be seen on examination of the pathological report. The growth we had to

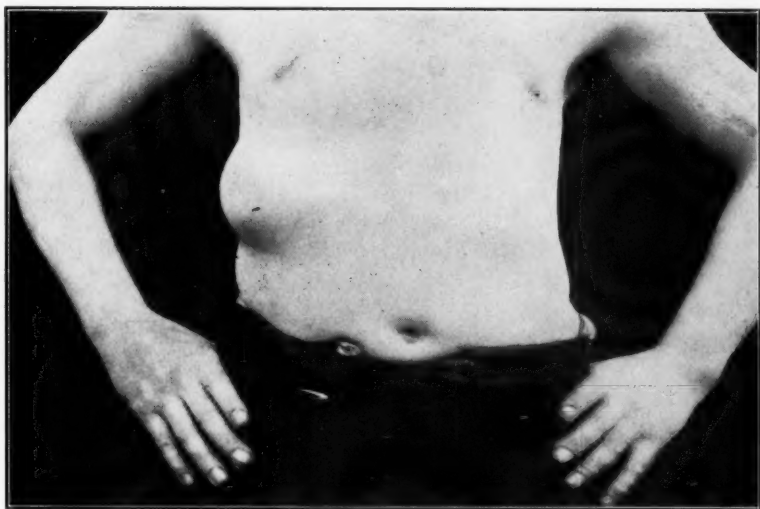
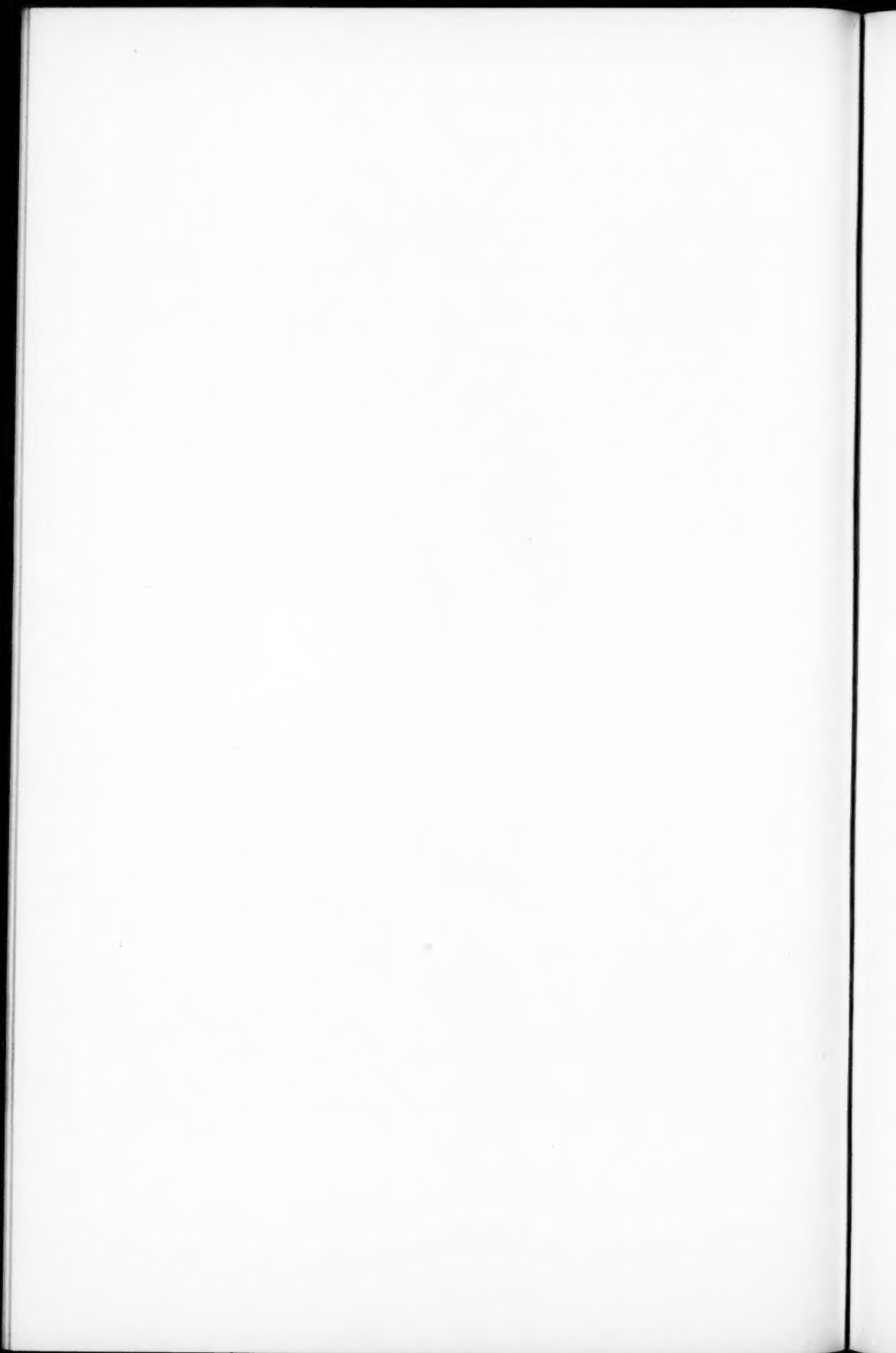


FIG. 1.—Showing the position of the growth seen from the front.



FIG. 2.—Side view showing the location of the growth.



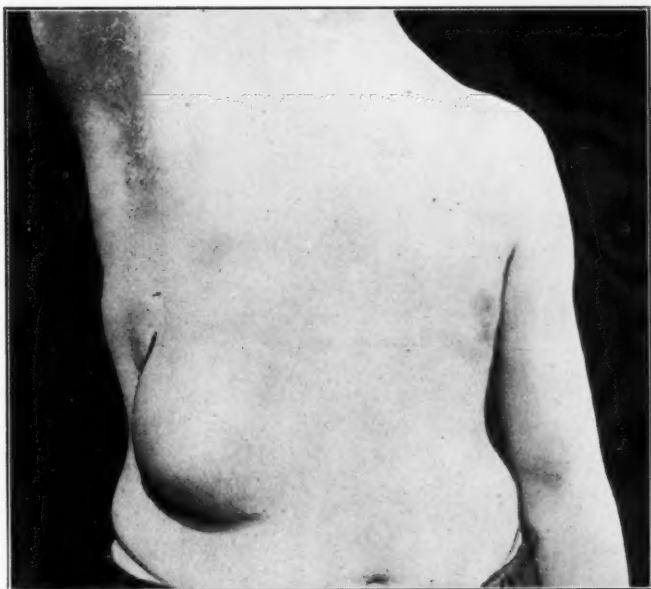
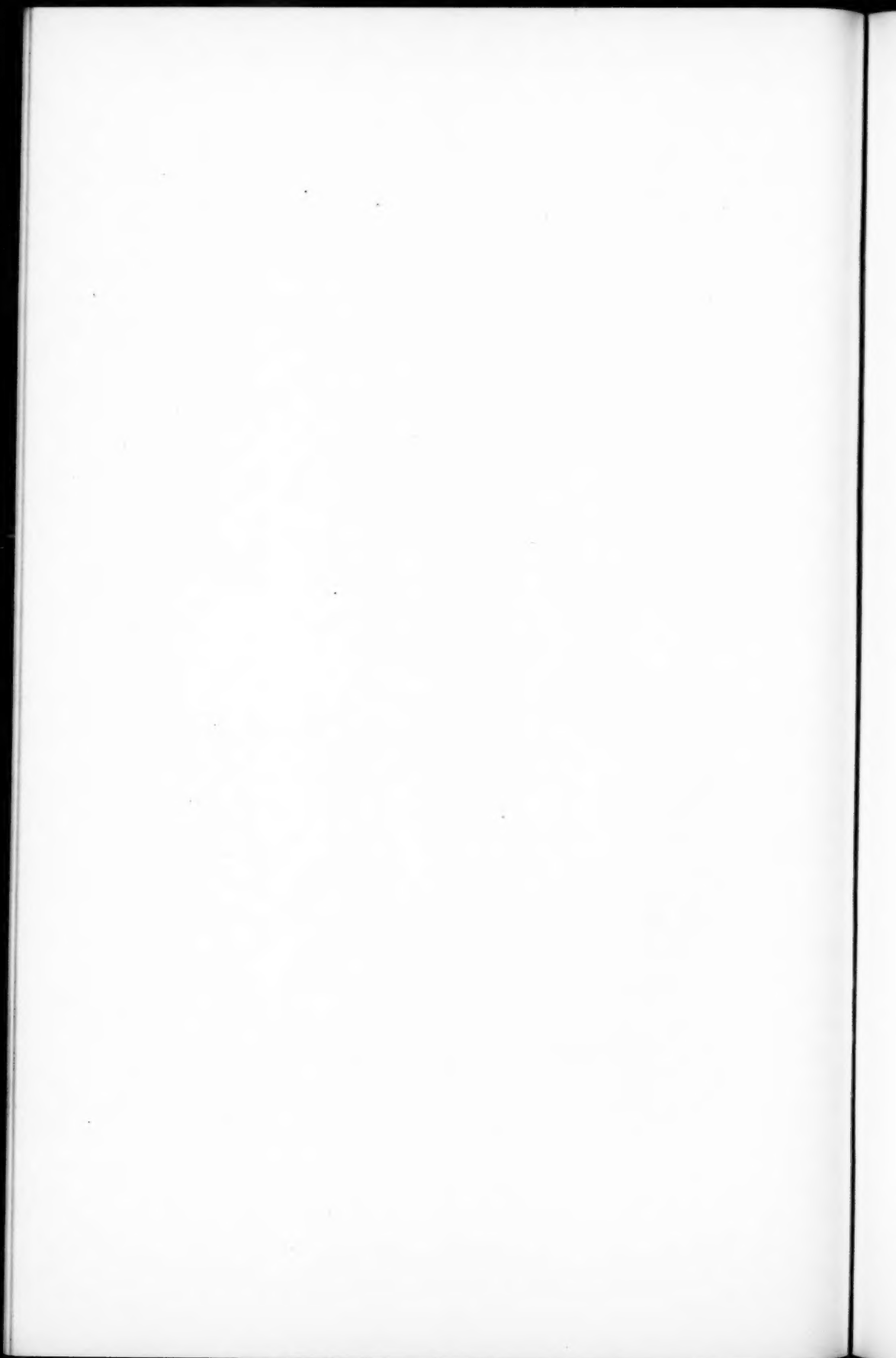


FIG. 3.—Front view after operation, showing hernia through opening in ribs.



FIG. 4.—Side view after operation, showing cicatrix.



deal with was the telangiectatic type of a myelogenous sarcoma. In this form of growth the blood-supply is carried on by sinuses irregularly arranged. It was the bleeding from these sinuses, which could not be clamped, that gave rise to this difficulty.

On examining the exposed surface of the ribs, the growth was found to have involved the seventh, eighth, and ninth ribs, which was confirmed by frozen sections.

These ribs were then divided in the midaxillary line, clearing the margin of the growth by three-fourths of an inch. On elevating the ends of the divided ribs, the lung could be seen in a partially collapsed condition.

The condition of sudden shock due to collapse of the lung, which had been anticipated on account of the experiences of other operators, did not occur. Dr. M. H. Richardson, who watched the pulse at this stage of the operation, noticed no immediate change in the rate or quality. There was no cyanosis nor respiratory distress, the rate and depth of the respiration, however, increased.

The intercostal muscle between the sixth and seventh ribs was next divided with the costochondral ligaments and cartilage. On elevating the upper portion of the ribs thus divided, the growth from the ribs was found to have extended into the pleural cavity. The intrathoracic portion of the growth was cylindrical, covered by a reflection of the parietal pleura, with its long diameter pointing downward and inward.

The intercostal muscle, costochondral ligament, and cartilage of the ninth and tenth ribs were next divided. It was now found that the lower pole of the intrathoracic portion of the tumor was adherent to the diaphragm. An effort was made to dissect the growth away. This, however, could not be done without leaving a portion of the sarcoma on the diaphragm.

The diaphragm was then cut away from the growth by an elliptical incision, removing half an inch of normal diaphragm outside the margin of the malignant growth. With this the ribs, tumor, and diaphragm were removed.

On opening the diaphragm, the intestines came through into the pleural cavity. They were replaced and held back by gauze. The opening in the diaphragm was then closed by a "shoemaker's stitch" of animal tendon. After tying the intercostal arteries and several other vessels, the skin flap was turned down and closed

with interrupted silkworm-gut sutures. At the upper end of the incision an opening was left, through this a rubber tissue gauze wick was put into the pleural cavity.

At the close of the operation the patient was suffering considerably from shock. The shock came on gradually, and was evidently due to the loss of blood and not from the condition of the lung. He was infused with 1000 cubic centimetres of normal salt solution and stimulated. The pulse was 160.

On recovering consciousness the patient suffered from dyspnoea, which was much relieved by the administration of oxygen. The oxygen was used during the first week.

The respiration was wholly thoracic. On the following morning the patient had reacted from the shock.

On the second day respiration could be heard at the level of the fifth rib, and on the third day at the sixth rib in the mid-axillary line.

On the fourteenth day the chest was examined by Dr. R. C. Cabot, who found that the right lung had reached its full expansion, and that the respiratory sounds were normal. The wick and stitches were removed on the tenth day, and on the eighteenth day the patient was allowed to be up.

The patient was up and about on the twenty-first day as usual, when he had a severe chill followed by a temperature of 104.5° F. Nothing abnormal was found in the chest at this time. Four days later fluid was found in the right thoracic cavity at the level of the fourth rib in the midaxillary line. Drainage was not employed in hopes that the exudate might absorb.

Ten days later fluid was still present and the upper end of the incision was reopened. Several ounces of a brownish, straw-colored fluid, the consistency of consommé, came out. Cultures from this fluid showed numerous colonies presenting a variety of diplococci; no streptococci were present. Drainage was continued for two weeks; from now on the convalescence was rapid. The sinus closed at the end of two months.

Sixteen months after the operation the patient was seen. He has gained thirty-eight pounds, and there is no evidence of recurrence of the sarcoma. There is a marked bulging between the ribs bordering the resected area. This condition has been increased by the patient's occupation, which requires him to work in the stooping position.

Pathologist's Report by Dr. W. F. Whitney.—The specimen consisted of three ribs, two of which were more or less intact, the longest measuring thirteen centimetres. From the middle rib there started a growth of a somewhat hour-glass shape, consisting of a continuous extra- and intrapleural growth. The opening through which the tumor mass passed measured nine centimetres in diameter. The surface was more or less smooth, somewhat lobulated. The two parts of the growth each measured 12.5 by eight centimetres.

The section surface was grayish, homogeneous, and speckled with a few hæmorrhagic and opaque necrotic areas.

Microscopic examination showed, in general, a round or elongated cellular growth with a little fibrous-looking intercellular substance, through which were scattered innumerable large, multinucleated cells. The blood seemed to circulate, generally, in spaces or cavities, but here and there was a well differentiated, vascular wall.

Diagnosis.—Medullary (giant cell) sarcoma, evidently originating in the rib.

CONGENITAL ANTERIOR DISLOCATION OF THE TIBIA TREATED BY ARTHROTOMY.¹

By JOHN B. ROBERTS, M.D.,

OF PHILADELPHIA.

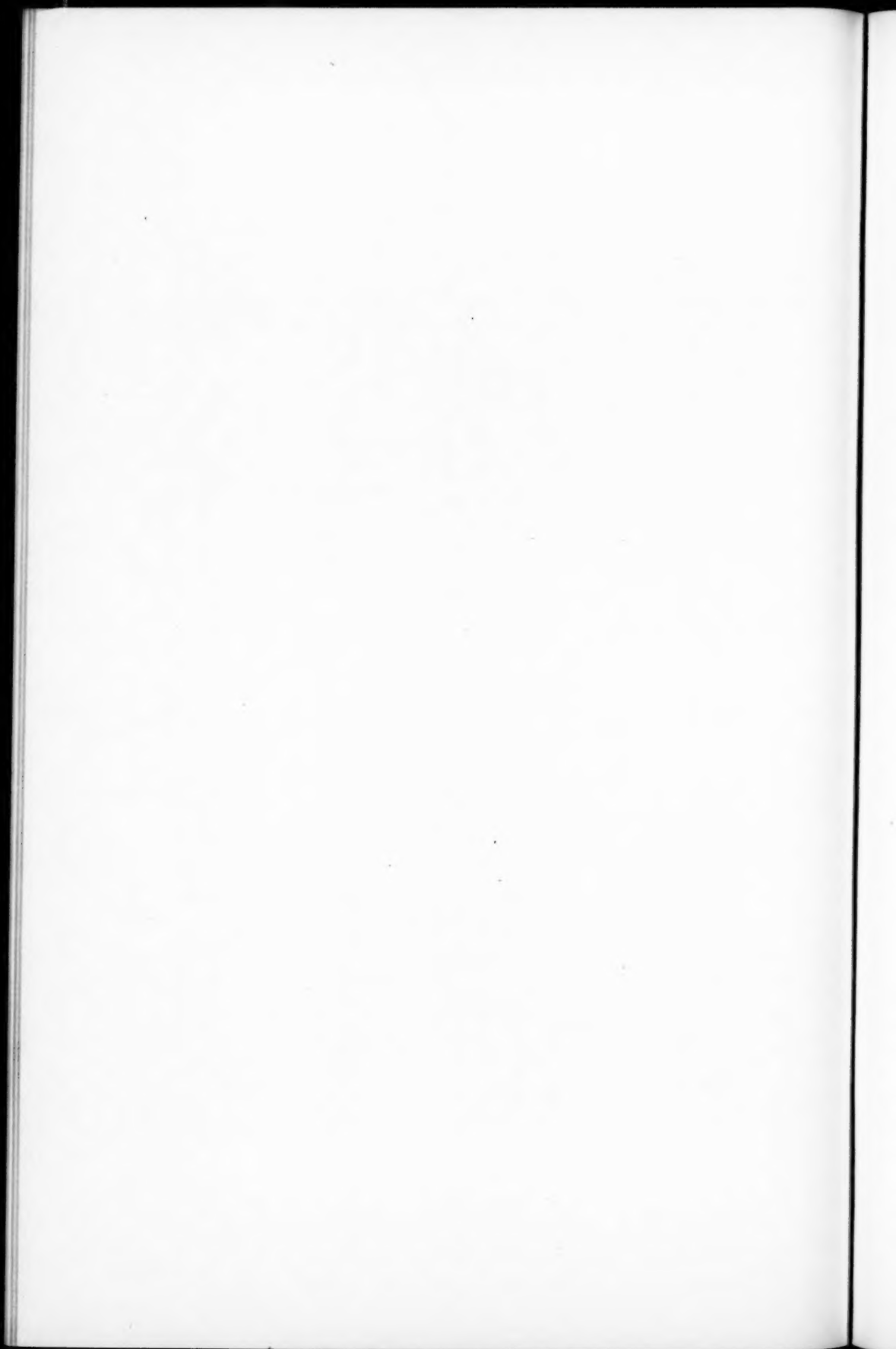
A LITTLE girl aged five years, born after a hard labor, was brought to me for deformity of the left knee by Dr. F. S. Nevling. I found that the tibia was displaced forward on the femur, so that when the child lay upon her back the tibia extended upward, making an angle with the plane of the bed of about fifty or sixty degrees. The small patella could be felt in the hollow above the head of the tibia. The condyles of the femur, with the popliteal artery beating between them, could be felt at the posterior part of the joint close to the surface of the limb. The child had learned to stand on both legs by bending the spine in the lumbar region, so that there was a marked lordosis. The abdomen was very prominent, and the costal cartilages of the ribs were thrust forward in such a manner as to deform the chest. The girl's head was large and suggested intellectual deficiency. The mother, however, stated that she was as bright as the other children, and had learned to talk before the end of the first year. A skiagraph was taken and showed the deformity to be that suspected,—namely, anterior displacement of the tibia. The mother says that the labor at the time of the child's birth was a severe one, and that the presentation was a breech.

On March 22, 1901, I operated under ether for the reduction of the dislocation. A large horseshoe incision was made across the front of the knee so as to turn up a large flap. The ligament of the patella was divided by the angular incision which is often used in lengthening the tendon of Achilles. The lateral ligaments of the joint were divided almost, though not quite, completely. The dislocation was then easily reduced. It was

¹ Read by title before the American Surgical Association, May 9, 1901.



FIG. 1.—Congenital anterior dislocation of tibia. Skiagraph taken with plate on outside of limb.
Girl aged five years.



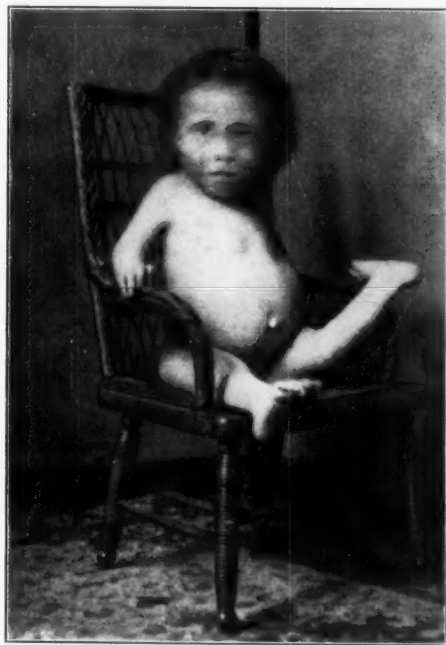


FIG. 2.—Showing abnormal position of left leg in sitting posture.

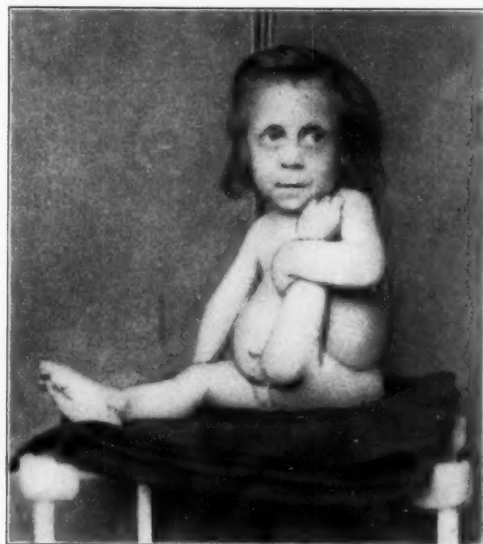


FIG. 3.—Showing abnormal position of left leg and prominence of condyles of femur in popliteal space.

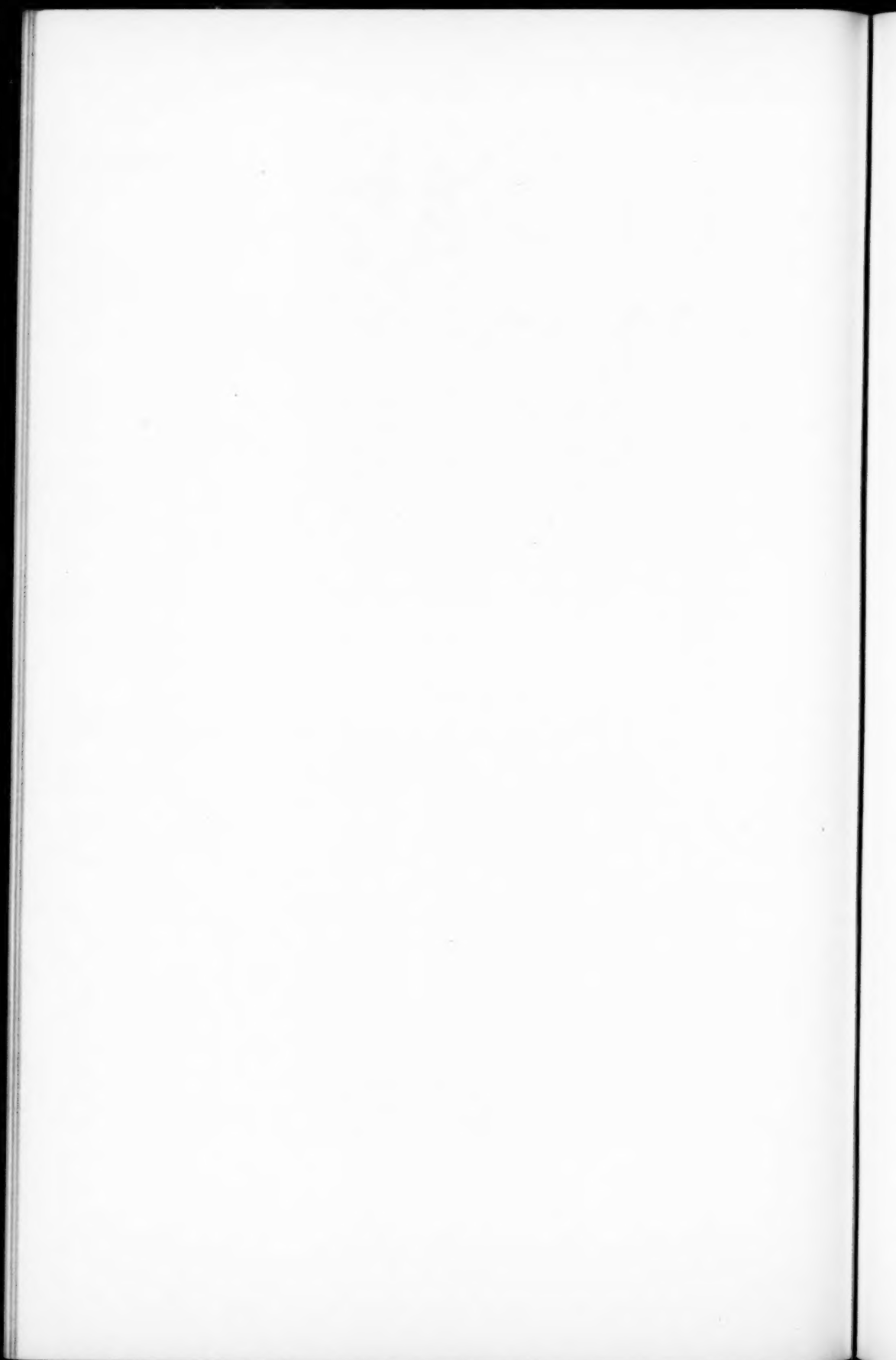
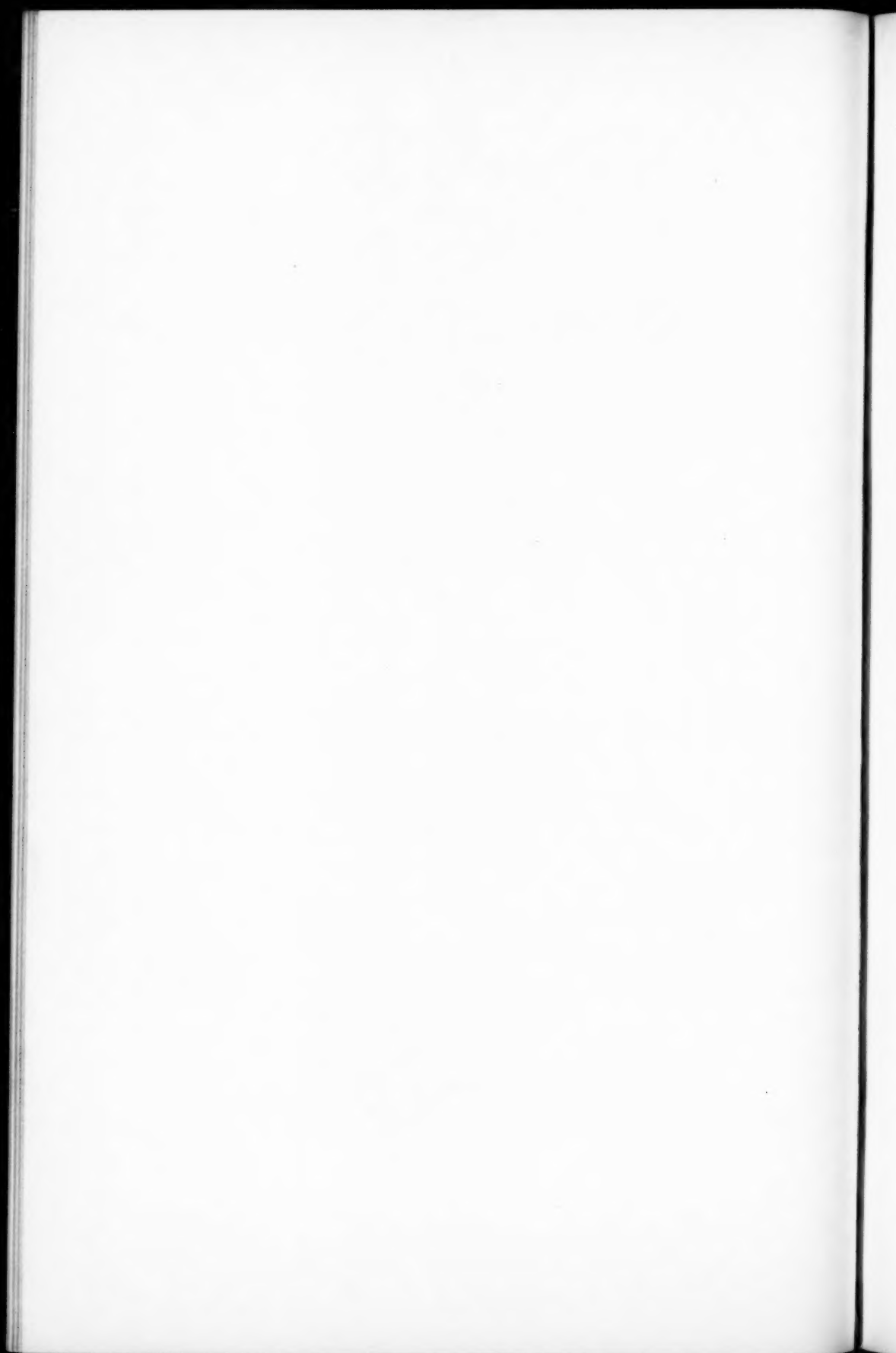




FIG. 4.—Showing erect posture assumed by child. The right hip and knee are flexed; the left limb rests on condyles of the femur.



FIG. 5.—Showing lordosis of spine caused by erect posture.



found impossible to unite the ends of the ligament of the patella, though a third of an inch had been gained by the manner of making the angular incision through it. It therefore became necessary to lengthen the four-headed muscle attached to the upper portion of the patella. This was done by exposing the muscle through a longitudinal incision, carried upward on the front of the thigh from the original horseshoe incision. The lower end of the muscle was dissected free from the surrounding tissues, and a cut made across it from the inner side of the muscle to about the middle. This allowed the cut ligament of the patella to be drawn together perhaps half an inch more.

Strong chromicized catgut sutures, four or five in number, were passed through the tendon of the quadriceps and the lower piece of the ligament of the patella and the tissues in front of the tibia. Three of these sutures went through the tendon of the muscle above the patella, so that there would be less danger of the great tension tearing them out. By means of these sutures the divided ligament of the patella was brought nearly into apposition, while the tibia was kept slightly flexed on the femur. The external wounds were sutured and a catgut drain left in the outer side of the wound. The leg was then enveloped in an aseptic gauze dressing and fixed by means of a gypsum splint. On the 24th, the temperature of the child was high; the gypsum splint was then removed, the catgut drain withdrawn, a few stitches cut, and the joint irrigated with warm sterile salt solution. The next day the inner side of the wound and the upper extremity of the cut over the patella were opened, because of the fear of infection which was suspected to be the cause of the rise in temperature. Irrigation of the wound with sterile salt solution was continued.

It subsequently became necessary to lay open practically the whole wound and put a drainage tube through beneath the patella. The cause of the infection was not clear; but from this time the case was treated by frequent irrigations with corrosive chloride solution, and subsequently with formaldehyde solution. The wound slowly closed, and the child was sent to her home in the country at the end of a number of weeks with a straight limb, which, however, was greatly restricted in motion at the knee-joint. It is probable that under massage and careful passive motion of the joint a considerable degree of mobility may be

obtained. The desire of the parent to take the child home prevented further careful supervision of the treatment. There was a tendency, at the time I last saw the child, to moderate external deviation of the tibia, producing a condition a little like knock-knee. I have advised the wearing of a brace on the leg and the use of massage. The skiagraph and photographs taken before the operation show the deformity and the peculiar attitudes assumed by the child in the endeavor to use the deformed limb in walking. I believe that under careful orthopædic treatment the spinal curvature, due to the abnormal posture of the child necessitated by the dislocated knee, could be greatly diminished. It is to be feared that she will be unable to obtain this sort of surgical treatment in her home, which is distant from large hospitals.



Ultimate result obtained in Cressy's case of cancrum oris.

CANCNUM ORIS SUCCESSFULLY TREATED BY EXCISION OF THE CAUTERY.

By A. Z. C. CRESSY, M.D.,

OF WALLINGTON, SURREY, ENGLAND.

AMONG the diseases which, with improvements in general hygiene, are distinctly decreasing with us, is cancrum oris. When the disease does occur, its gravity, the call for instant effectual treatment, the too frequent failure of treatment to save life, and, in the few cases which survive, the horrible deformity which follows, all these are well known. Owing to the good results obtained in this case, and the effective treatment adopted, the following history will be of interest.

On December 4, 1900, I saw A. R., aged seven years, suffering from a slight attack of measles, an epidemic which affected eighty cases. December 7, a small, sloughy spot was noticed on the gum behind the right upper canine tooth. December 12, I was sent for, as the face was much swollen, and it was now evident that we had to deal with cancrum oris spreading on the contiguous surfaces of gum and cheek with a large gangrenous mass in the centre surrounded by an extensive area of angry-looking indurated tissue. The cheek was much swollen, glazed in appearance, very hard, and showing every sign of quickly becoming involved.

It was clear that, unless speedy steps were taken of a radical kind, the whole cheek would slough. The friends, having the probable course and result of the case explained to them, left the patient in my hands. Through the kindness of Dr. Fegler, of the Croydon Rural Sanitary District, my patient was given a bed in a small ward in the District Hospital for Infectious Cases, with two excellent nurses. Assisted by Dr. Fegler, who gave chloroform, I cut through the upper lip and cheek very nearly as far as the zygoma, the knife passing right through the

sloughy mass. I then dissected this away from the cheek and then from the gum. Two teeth that were surrounded by infected tissue were also removed. Next the dentoline cautery was freely applied to all the old tear laid bare. Finally, the edges of the incision were drawn together with sutures.

The after-treatment consisted chiefly in irrigation of the mouth with boracic acid lotion every two hours, the mouth being also washed out after food. The cheek healed by primary union; the cauterized surface inside came away in sloughs and then granulated rapidly. After the first day the child's temperature remained normal. The result is a linear scar across the cheek, as shown in the illustration, somewhat fixed to the upper maxilla, with consequent immobility of the upper part of the cheek. The lower lip moves freely, and the upper one fairly well.

It is easy to see, and that if it had been possible, it would have been well to avoid cutting across the cheek, and to have applied the cautery from within without any incision. But considering the usual fatality of the disease, the terrible deformity produced, if it be not fatal, the consequent plastic operation required, and the resulting scarring, I am of opinion that early interference with the knife and cautery in this case is most encouraging.

FORWARD DISLOCATION OF THE SEMILUNAR BONE.

By PERCIVAL R. BOLTON, M.D.,

OF NEW YORK,

SURGEON TO THE NEW YORK HOSPITAL.

A MAN, aged forty-eight years, stumbled and fell heavily upon the thenar and hypothenar eminences of the hand, with the wrist presumably in dorsal flexion. Examination showed the hand, wrist, and fingers to be moderately swollen. The fingers were hooked.

(1) Viewed from the dorsal aspect, there is no radial displacement of the hand. (2) The palmar aspect: there is ecchymosis of the thenar and hypothenar eminences and of the anterior surface of the lower fifth of the forearm, which presents immediately above the centre of the transverse creases of the wrist; moderate tumefaction. (3) The radial aspect: there is slight prominence of the dorsal surface of the forearm immediately above the carpal region and slight forward displacement of the hand; there is some fulness of the anterior surface of the lower end of the forearm.

There is tenderness over the dorsal surface of the radio-carpal joint. The styloid process of the radius is slightly elevated above its normal level.

The fulness of the anterior surface of the lower part of the forearm is at its centre of bony consistency. The bony mass is apparently one-half to three-fourths of an inch in diameter, and is situated behind the flexor tendons, and at about the level of the radiocarpal joint lapping the radius (and ulna). It is fixed.

Active flexion and extension of the wrist is lost, pronation and supination nearly normal. Passive flexion and extension are very slight, about fifteen degrees each. Active motion of the fingers is absent. Passive extension causes great pain. There is

pain, but not anæsthesia, in the distribution of the median nerve in the hand.

The fluoroscope and radiographs show the semilunar to be displaced forward, to lie anterior to and against the margin of the articular surface of the radius, and to be inverted, *i.e.*, rotated about a transverse axis through 180 degrees. There is also a fracture of the styloid process of the radius.

In Stimson's work, edition of 1900, it is stated that but thirteen instances of dislocation of the semilunar are recorded, and of these in eight the dislocation was forward.

The history of the case here reported, together with the evidence of contusion of the thenar eminences, makes it probable that the dislocation occurred with the wrist in dorsal flexion; and the associated fracture of the styloid process of the radius is confirmatory of this conclusion.

The radiograph shows apparent inversion of the dislocated bone, and the same appearance is shown in the radiograph facing page 470 of Dr. Stimson's book. If this inversion really exists, it must naturally exclude the possibility of reduction in subcutaneous dislocations without resort to incision, for by no other means could the bone situated beneath and crowded against the radius by the flexor tendons be sufficiently controlled to rotate it prior to reduction; and its reduction in its inverted position could hardly fail to result in great impairment of the wrist.

From the diagnostic stand-point, the injury simulated in some respects a Colles's fracture, with moderate displacement of fragments, but the radiographs cleared the diagnosis at once.

[NOTE.—The patient refused incision and passed from observation.]



FIG. 1.—Anterior aspect.



FIG. 2.—Posterior aspect.

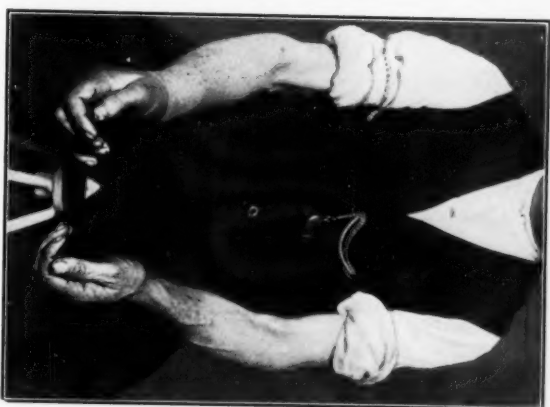


FIG. 3.—Lateral (radial) aspect.

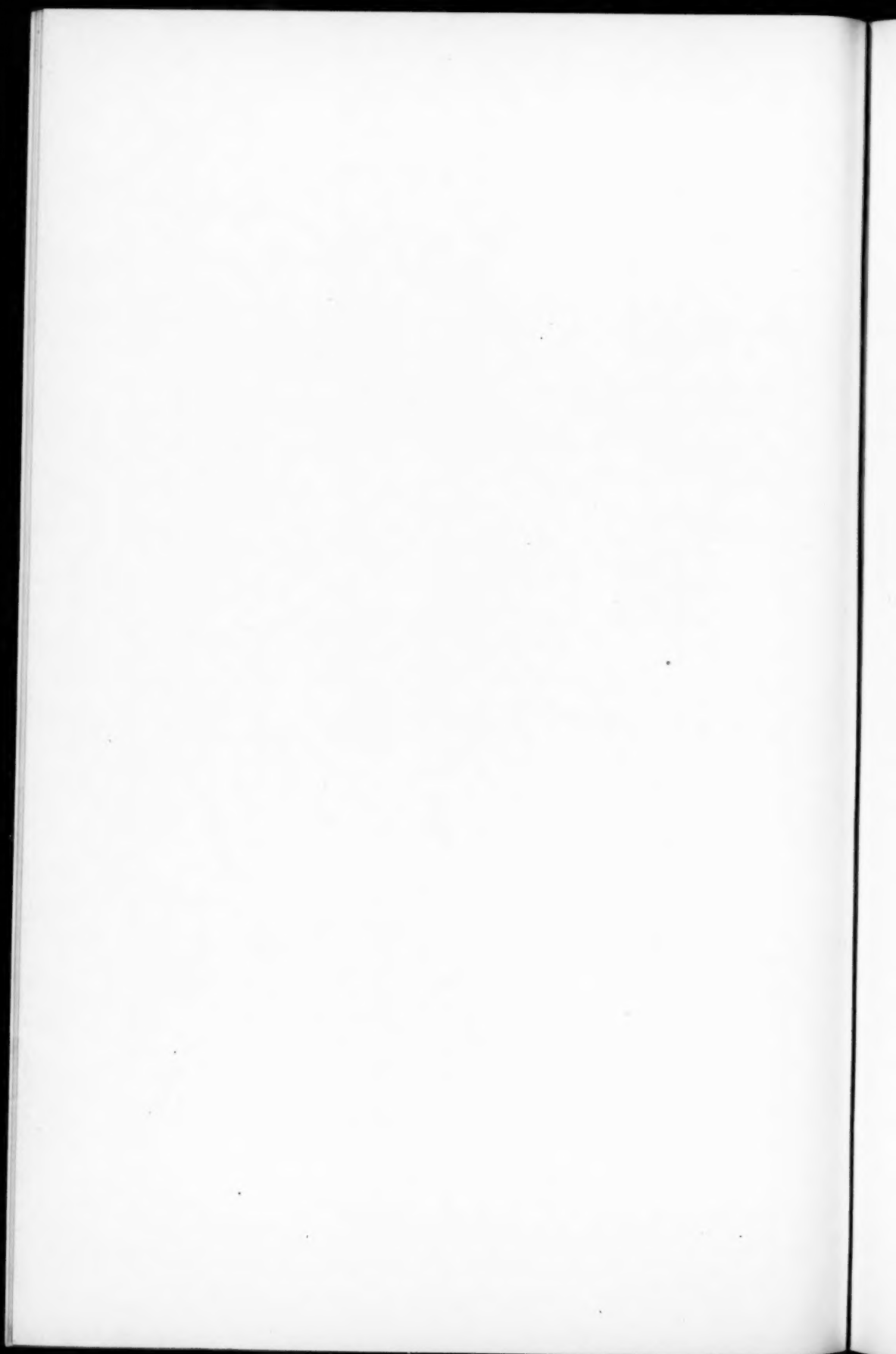




FIG. 4.—Forward dislocation of the semilunar bone, and fracture of the styloid process of the radius—anteroposterior view.

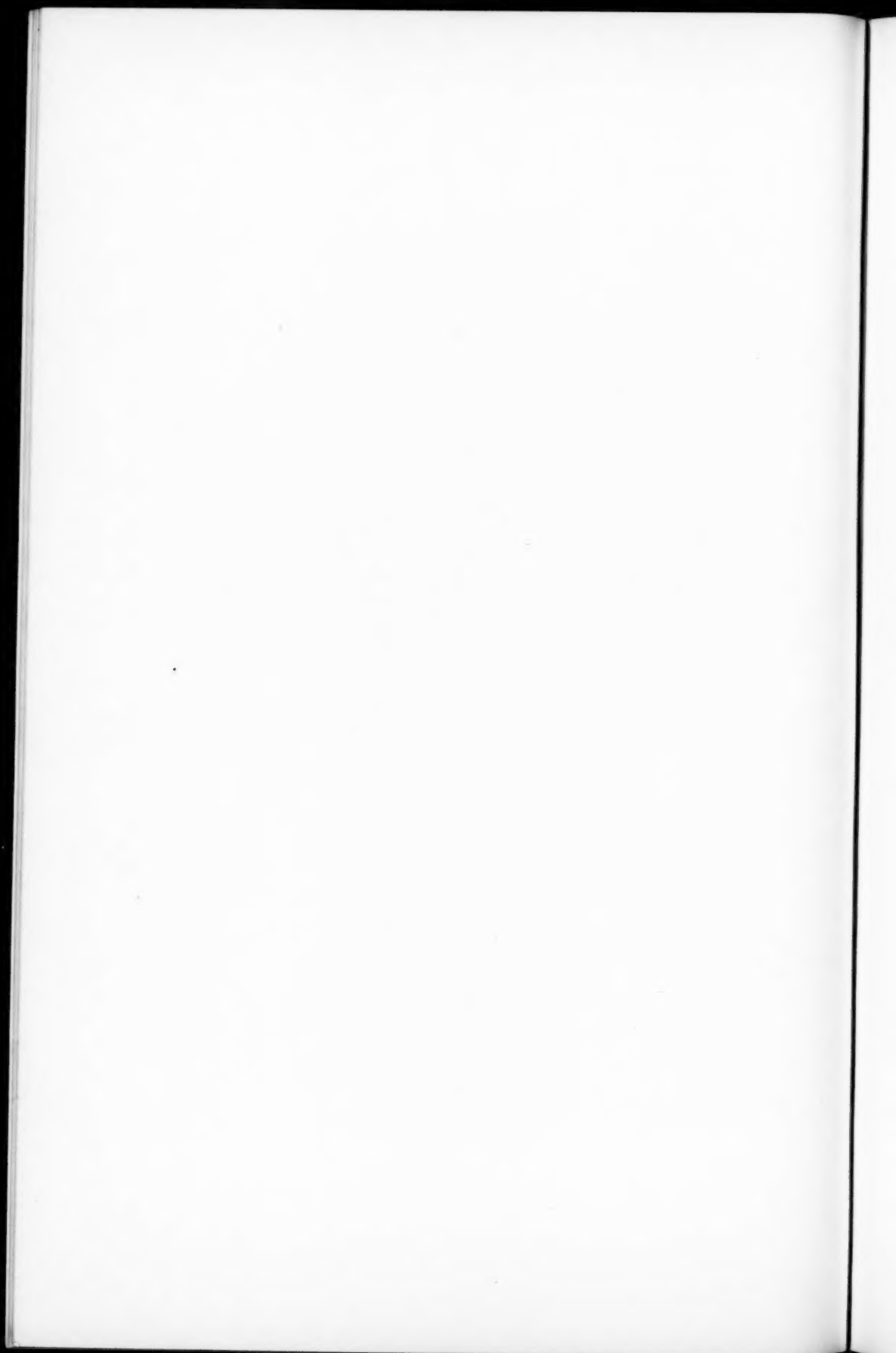
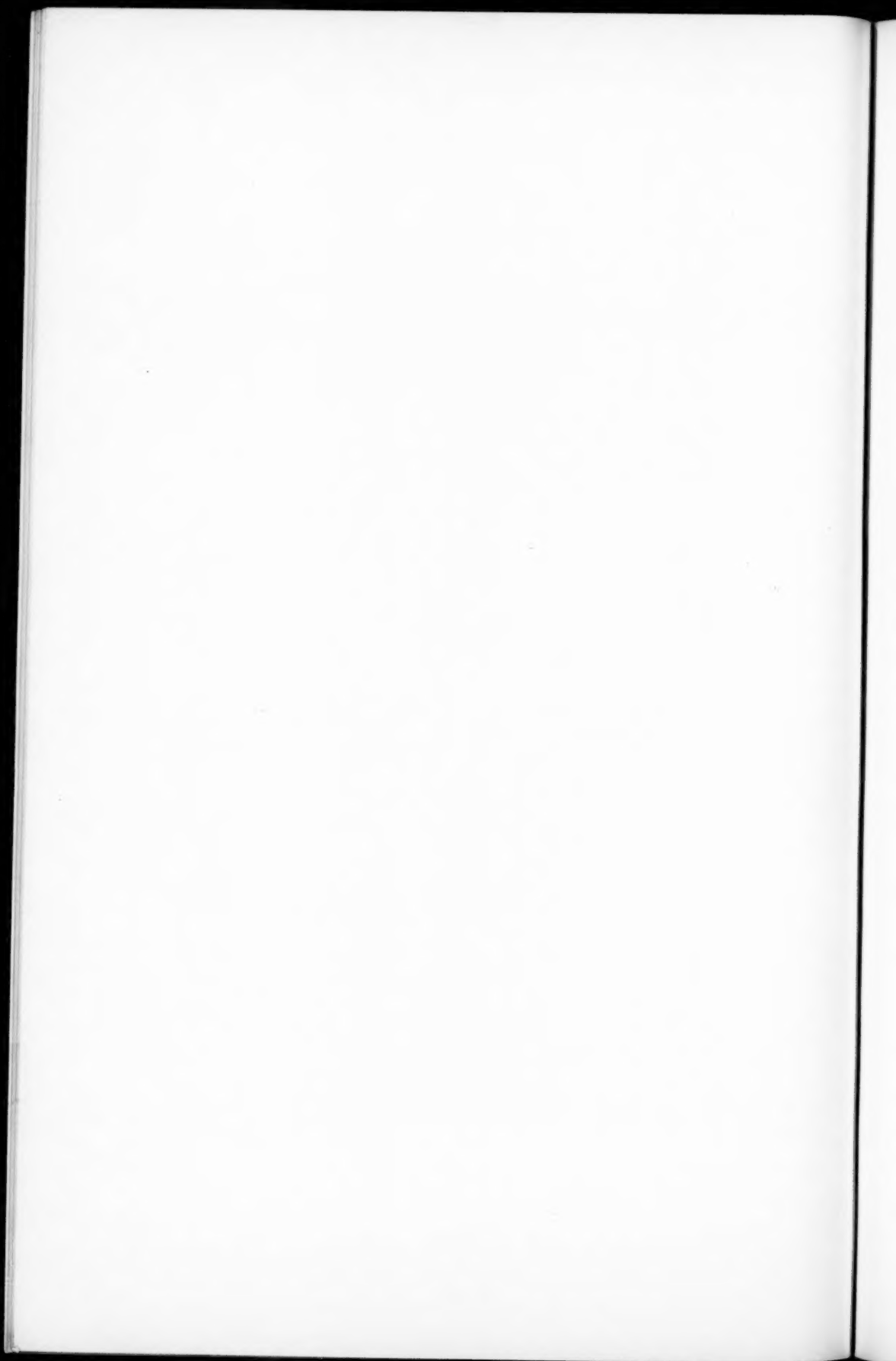




FIG. 5.—Forward dislocation of the semilunar bone—lateral view.



TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, February 27, 1901.

JOSEPH D. BRYANT, M.D., in the Chair.

TRAUMATIC RUPTURE OF THE INTESTINE.

DR. ELLSWORTH ELIOT, JR., presented a boy who was brought to the Presbyterian Hospital last October with the following history. While running in front of a Third Avenue trolley-car he was struck by the fender and hurled against an Elevated Railroad pillar. He was rendered unconscious, and brought to the hospital in a condition of shock and apathy; his pulse was 120; there were numerous abrasions and scalp-wounds on the head and face. He recovered consciousness two or three hours after the accident, and was able to answer questions. He complained of pain in the abdomen, chiefly on the left side. His most comfortable position in bed was one which relaxed the left abdominal muscles, and his pain on that side was intensified when he was placed on the back. There was marked tenderness on that side and dulness on percussion. His pulse ranged from 125 to 130. When he was examined again, six hours later, his pulse was about the same, his temperature 101.5° F., and the pain and tenderness had extended to the opposite side. In the meantime he had also had two or three attacks of vomiting.

As further delay seemed unwise, an incision was made along the outer margin of the left rectus muscle, over the point of maximum tenderness. When the peritoneum was opened, a certain amount of serous fluid escaped, and the intestine which presented was moderately congested and swollen. A number of pads were introduced, and when one was withdrawn shortly afterwards, it showed the presence of fecal matter. The right side of the peritoneal cavity was walled off as completely as possible by means of pads, and the congested gut was then drawn within

the wound. Upon close examination, a loop was discovered in which was situated a rent which involved the entire thickness of the intestinal wall; it was transverse to the long axis of the gut and involved about one-third of the circumference; the mesenteric attachment, however, was not involved. Through this rent a large quantity of semi-solid intestinal matter had escaped. The rent was closed, first by catgut sutures passed through the entire thickness of the intestinal wall, and then these were reinforced by a row of Lembert sutures. The congested portion of the gut was then washed with saline solution, and, after returning it to the peritoneal cavity, it was again walled off by clean pads. This section of the abdominal cavity was then thoroughly sponged and irrigated, and the wound was left open, the pads being replaced by sterilized gauze and iodoform gauze being employed for drainage. At the completion of the operation the boy's pulse was 140. He was given a saline infusion of 1000 cubic centimetres, and put to bed. During the first thirty-six hours he vomited at intervals, but this was at once relieved by lavage of the stomach. On the second day his pulse was 120; on the third day it ranged from 100 to 110, and from that time on it rapidly fell to normal. The wound healed fairly well, and at the end of a month it had closed entirely.

About two months later a secondary operation was done for the relief of the ventral hernia which had persisted after closure of the wound. At this operation, which was done about six weeks ago, some adhesions of the small intestines were found, which were dissected loose. The hernial opening was then closed, and up to the present time there are no signs of a recurrence.

Dr. Eliot said that in this case he only partially eviscerated the intestines, and he inquired whether in cases of this character the members favored complete evisceration or partial evisceration, or none at all? He also asked how they would treat the wound, —whether by the open method or not?

DR. ROBERT ABBE said that from his rather limited experience with this class of cases he was strongly prejudiced in favor of not eviscerating at all, because the peritoneal cavity can be thoroughly irrigated in every fossa by making ample incisions. The irrigation should, of course, be done with hot saline solution, and, after thorough cleansing, the omentum should be drawn downward so as to completely cover the small intestines, if

possible. When this is done, it avoids the kinking that is apt to occur when the intestines are left in contact with the dressings, and, furthermore, quick peristalsis is established underneath this apron of omentum, and infection is less likely to take place.

As regards the treatment of the wound, Dr. Abbe said he was in favor of leaving it open.

DR. GEORGE R. FOWLER said he was thoroughly in accord with the statement made by Dr. Abbe regarding the importance of drawing down the omentum over the small intestines in the treatment of this class of cases. It not only protects the intestines, but also serves as the natural avenue through which the local leucocytosis is accomplished and infection destroyed.

As regards evisceration, Dr. Fowler said he favored it in those cases where a large amount of fæcal matter had escaped into the peritoneal cavity, or where considerable time had elapsed since the occurrence of the accident. In the treatment of the wound, the speaker said, he favored as complete closure as possible.

DR. GEORGE WOOLSEY said he did not consider that careful evisceration was necessarily harmful to the patient, while on the other hand it gives the surgeon an opportunity to thoroughly inspect the wounded parts so that no lesions are overlooked, and it permits of better cleansing. Personally, he did not believe that the peritoneal cavity in cases of this character could be thoroughly cleaned without evisceration; by removing the intestines, we cannot only cleanse them, but also the peritoneal cavity itself, including the pelvic region. After this has been thoroughly done, it is not necessary, as a rule, to leave the wound wide open. If closure of the wound with drainage is safe and possible, it is of course desirable. The condition of the patient also affects the question of evisceration; it is contraindicated if there is much shock.

In reply to a question as to whether he resorted to evisceration in all cases, Dr. Woolsey said not in all. It would depend upon the nature of the case, the condition of the patient, and the time that had elapsed since the accident. Extensive evisceration would probably be unnecessary in a case like the one presented by Dr. Eliot, where the injury was confined to a single rupture. It would more likely be indicated in a case of multiple rupture or perforation of the gut, as in gunshot wounds.

DR. CHARLES L. GIBSON said the subject of evisceration and

its relation to shock had been recently carefully investigated by Tixier, who showed by experimental work upon animals that if the peritoneum is in a healthy condition, there is at first a period of absolute quiescence—"a period of indifference"—of the peritoneal reflexes after evisceration. This quiescence of the reflexes is in direct ratio to the condition of the peritoneum. When there is acute peritonitis, the period of quiescence is short and the reflex action is severe, while under normal conditions evisceration seems to be a comparatively innocuous procedure.

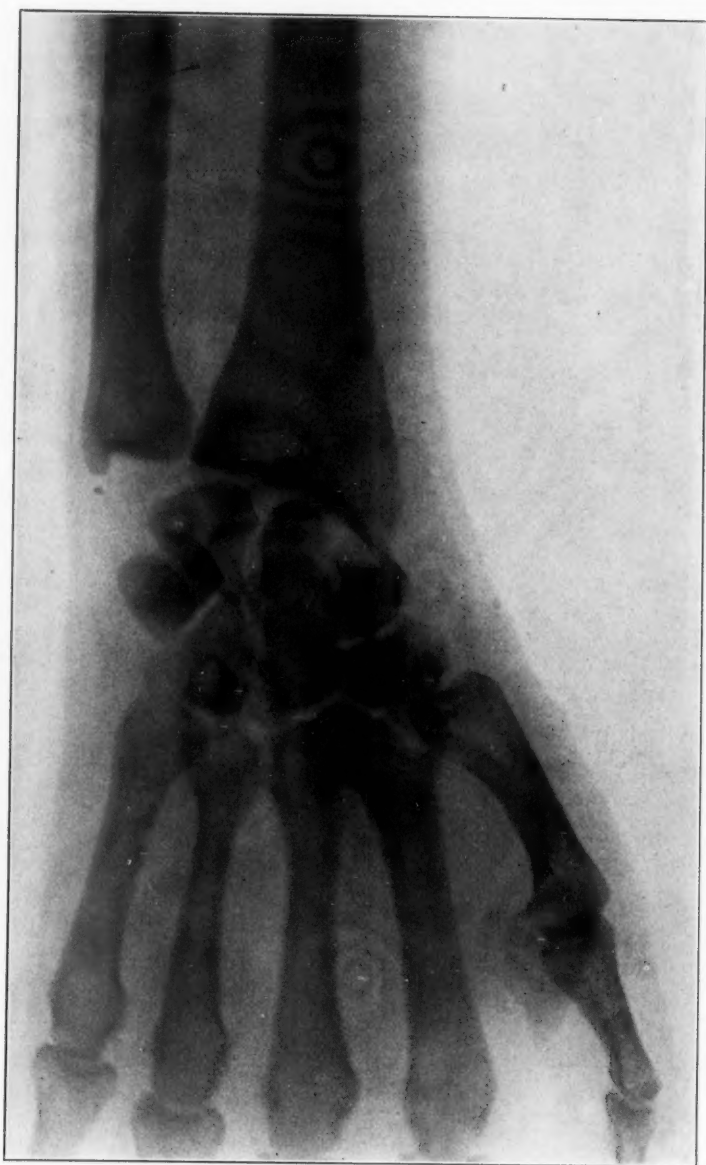
UNDESCENDED TESTIS.

DR. SAMUEL ALEXANDER presented several cases of undescended testis treated by a procedure which was practically a combination of the methods commonly employed in dealing with this condition. It consists, essentially, in freeing the vas deferens entirely from the cord and pushing back the peritoneal reflection from the cord as far as may be necessary to restore the latter to its normal length. In many cases the latter step is not required. The other point consists in recognizing the fact that the inguinal variety of undescended testis is due to adhesions (principally at the internal ring) of the fascia arising from the transversalis and cremasteric muscles. The completion of the operation is practically the same as that followed in the Bassini method of operating for hernia.

In one of the cases shown by Dr. Alexander, the non-descent of the testis was complicated by tuberculosis of the epididymis.

DR. JOHN B. WALKER said that, in twelve cases of this condition which had come under his observation, the cause of the non-descent of the testis was practically the same as that described by Dr. Alexander, that is, it was due to the fact that the cremasteric fascia was too short. In a number of cases in children, where the testis was below the internal ring, it was practicable, after complete dissection, to bring it down into the upper half of the scrotum; and it was then held as low as possible by means of a catgut suture passed through the fascia at its base, and then through a loop of catgut which was passed through the thigh about four inches below.

DR. WOOLSEY said that a week ago he operated on a small boy with ventral hernia, and at the same time tried to correct an undescended testis. Instead of stitching the cord to the



Fracture of scaphoid bone and dislocation of the semilunar bone.

pillars of the ring, he stitched it to the soft parts just in front of the pubic spine, which amounts practically to the same thing. This boy had a brother with a double undescended testis who was in the hospital at the same time. He could not be operated upon on account of an outbreak of scarlet fever in the ward.

As to the cause of the non-descent of the testis, Dr. Woolsey said, he has not found in his cases that the cremasteric fascia had anything to do with it. In the cases he has observed, it was due either to a shortening of the infundibuliform fascia or of the vas deferens. He did not know which of these two was the more common cause.

DR. JOSEPH D. BRYANT said that in several of his cases of undescended testis the cremasteric muscle was distinctly at fault, and in one the non-descent was due to the fascial structures surrounding the cord. He was never able to attribute it to the vas deferens.

Stated Meeting, March 13, 1901.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

FRACTURE OF THE CARPAL SCAPHOID, WITH DISLOCATION OF THE SEMILUNAR.

DR. JOSEPH A. BLAKE presented a man, aged twenty-two years, who applied for treatment at the Roosevelt Hospital on January 26, 1901, stating that the day before his horse had stumbled and falling upon him, injuring his left wrist. He was unable to tell how the force was applied. Examination revealed considerable swelling of the left wrist, and a slight deformity simulating that of a fracture of the lower extremity of the radius. There was, however, no tenderness over the radius, but tenderness on both dorsal and palmar aspects of the carpus just distal to the extremity of the radius. At this point bony crepitus was present. All motions of the wrist were painful, especially adduction and abduction. A diagnosis of fracture of one of the carpal bones, presumably the scaphoid, was made before the class, and a radiograph (see figure) subsequently confirmed the diagnosis.

The treatment has consisted in fixation, in as good a position as could be obtained, by dorsal and palmar splints for nine days,

and then with a long palmar splint alone for two weeks longer; the splints being removed daily for massage and passive motion. There is still swelling of the carpus with slight abduction and limitation of motion. Complete reduction was found to be impossible, and a late radiograph shows practically the same position of the fragments as at first, and also the same position of the semilunar, which is apparently dislocated from the head of the os magnum. According to Dr. Stimson ("Fractures and Dislocations," p. 286), these fractures are rare, and he has only known of one case of simple fracture in which the condition was recognized during life.

DR. CURTIS said that he had seen three of these cases during the past three years, and he expressed the opinion that excision and removal of the bone was the best method of treatment. The disability is usually so great that the operative method of treatment is decidedly to be preferred. In one of his cases where there was a posterior dislocation of the bone, function was fairly maintained, but in the other two, where the thickening was in front, the disability was very pronounced. In one of his cases the two rows of carpal bones were dislocated upon each other, and a prolonged attempt to reduce them was only partially successful; function was only slightly improved, and it would have been better to have resorted to an incision and removal of some of the bones, but the patient refused consent. Unless reduction is very easily accomplished in these cases, excision is preferable.

EXCISION OF GANGRENOUS INTESTINE DUE TO TORSION IN VENTRAL HERNIA.

DR. JOHN F. ERDMANN presented a woman, forty-two years old, who entered hospital on November 14, 1900, with the following history. Eight years before she had been operated on for an abscess in the lower abdomen, which from her description was possibly tubo-ovarian. The abdomen at that time was opened in the median line. She had not been pregnant since, but her menstruation had remained fairly regular. About three years after the operation a ventral hernia developed at the site of the scar; it had always been reducible and gradually increased in size.

During the night of November 13, 1900, she was seized with pain in the abdomen and vomited freely. At 5 P.M. on the following day, when she was first seen by Dr. Erdmann, she was in a condition of shock and presented a large, irreducible tumor. On

account of her condition, general anæsthesia was deemed inadvisable, and it was determined to employ spinal anæsthesia. Accordingly, twelve minims of a 2 per cent. solution of cocaine were introduced at the junction of the third and fourth lumbar vertebræ; this gave rise to some vomiting, which was controlled by a hypodermic injection of morphine. An incision was then made over the tumor. This was found to contain a loop of small intestine in a condition of volvulus, about a foot long, which had been produced by fibrous adhesions stretching from one coil to the other. As this section of gut was in a gangrenous condition, it was removed, and the two cut ends brought together over a Murphy button. The wound was packed and patient placed in bed.

Three days later, while the patient was making an uneventful recovery, she was etherized and the old ventral hernia repaired. For this purpose, on account of the attenuated condition of the abdominal wall, three layers of kangaroo tendon were inserted, and, finally, a silkworm suture was passed through the skin and underlying tissues. On the seventh day following the hernial operation the patient was seized with intense abdominal pain and went into a condition of collapse, from which she recovered. She had a similar attack on the following day. From that time on her recovery was uneventful.

CURED TRAUMATIC TORTICOLLIS.

DR. ROYAL WHITMAN presented a boy who had been shown on two previous occasions during the past four months, the first time by Dr. Dawbarn, who presented it as a case of possible fracture or dislocation of the atlas, and the second time by Dr. Whitman, to whom the patient had been referred by Dr. Dawbarn during the course of treatment, which consisted, essentially, of the application of a plaster jacket and a jury-mast, supplemented by manipulative correction and exercises. Under this treatment the boy had entirely recovered. He was again presented in order to demonstrate the complete disappearance of the bony irregularities caused by the distorted vertebræ, which together with the rigidity and deformity had simulated fracture.

EXTENSIVE DESTRUCTION OF THE SOFT PARTS OF THE LOWER LEG.

DR. WHITMAN presented a boy who three years ago fell down-stairs, fracturing his right thigh and lacerating the tissues.

According to the history given by the boy's parents, the wound became infected, resulting in extensive ulceration and destruction of most of the soft tissues of the right leg. In spite of the fact that the tibia and fibula are now merely covered by scar tissue, the circulation of the foot is sufficient, the blood-supply coming from the anterior tibial artery. The affected limb is three-quarters of an inch shorter than the opposite one, probably the result of the fracture of the femur. The extensive loss of tissue has apparently not interfered with the growth of the bones of the limb, and the function of the part, in spite of the limited motion at the ankle-joint, is but slightly impaired.

DR. ALEXANDER B. JOHNSON said that if his memory served him right, the boy had been treated at Roosevelt Hospital at the time of the original accident. The injury to the soft parts was very extensive, the muscles being practically destroyed. Probably the nerve-trunks were destroyed at the same time.

SARCOMA OF SUPERIOR MAXILLA.

DR. F. W. GWYER presented a girl, aged eleven years, who was admitted to hospital April 9, 1895. About three months before admission, she noticed a small swelling on the right side of the roof of the mouth, which grew rapidly in size, and at the time of admission formed a tumor occupying the entire right side of the roof of the mouth and projecting into it for over half an inch, and bulging the cheek on that side to a considerable extent. By transmitted light the tumor was found to be opaque, and was removed with the upper jaw on that side on April 30, 1895. It was not thought necessary to tie the carotids as a preliminary, nor to perform tracheotomy. The operation presented but few difficulties, and the patient made a rapid and uneventful recovery. The patient was presented six years after operation, perfectly well, without having suffered a relapse, and showing a minimum of scar and deformity.

BENIGN OBSTRUCTION OF THE PYLORUS TREATED BY GASTRO-ENTEROSTOMY.

DR. F. KAMMERER presented a woman, aged twenty-eight years, upon whom he had operated two years before. The history of the patient was one of gradually developing stenosis during the year previous to the date when first seen. Since her twelfth year she had suffered occasionally from pain in the epi-

gastrium, which was relieved by the ingestion of food. She had never shown any symptoms pointing to ulcer of the stomach.

When the patient came under the speaker's observation she was very much run down; she complained of pains in her stomach, and had spells of vomiting which came on every day or two. At such times large quantities were ejected without any effort; in fact, she could easily induce vomiting to relieve her pain and nausea. The stomach was much enlarged, holding about three or four quarts of fluid. Upon inflation, it extended below the umbilicus. A movable tumor was readily made out in the epigastrium to the right of the median line. After a test meal, an examination of the stomach contents revealed the presence of hydrochloric acid in reduced quantity.

Owing to the enfeebled condition of the patient, it was decided to do a posterior gastro-enterostomy at first, whatever the nature of the tumor might be. On opening the abdomen a smooth, evenly shaped, firm tumor was found occupying the region of the pylorus. It was about the size of a hen's egg and freely movable, without any adhesions to the adjoining organs. The large curvature of the stomach was found about three inches below the umbilicus. After doing a posterior gastro-enterostomy with Murphy's button the wound was closed. This operation was done in September, 1899, and five weeks later, the patient's general condition having improved very much, the abdomen was again opened for the purpose of removing the growth; but, although a most careful palpation of the pylorus was made, no trace of it remained. The inference plainly was that the tumor was inflammatory in character, and was probably the results of an ulcerative process at or near the pylorus. Such instances of the disappearance of inflammatory tumors are not rare; but the speaker said he knew of no other case in which such a large growth disappeared in so short a time, as was actually demonstrated by the secondary laparotomy in this case. As the Murphy button had not been passed, a search was made for it at the second operation, and it was found in the stomach, from which it was removed by a gastrotomy. Dr. Kammerer said that in about twenty-four cases of posterior gastro-enterostomy with the Murphy button, he had only seen two instances in which the button escaped into the stomach, whereas in anterior gastro-enterostomy this happened quite frequently. He attributed this to the fact that when the patient is in the re-

cumbent position, evacuation of the stomach after posterior gastro-enterostomy is a more continuous process than after the anterior operation, and the button is therefore continually pushed in the right direction. The patient made an uneventful recovery from the operation, and since she has gained over forty pounds in weight. The stomach has become much smaller, and will now only hold from a pint to a quart of fluid.

Dr. Kammerer said that Rydygier has recently again recommended resection of the stomach in cases of gastric ulcer on account of the danger of the occurrence of cancerous degeneration in these cases, and of hæmorrhage, even after gastro-enterostomy. He did not himself think that the results of pylorectomy sufficiently certain to warrant a general application of this rule.

POSTERIOR GASTRO-ENTEROSTOMY IN A CASE OF GASTROPTOSIS WITH PERSISTENT VOMITING.

Dr. KAMMERER presented also a young woman of a neurasthenic type, who first came under his observation about two years ago. Her abdomen was pendulous and the stomach was somewhat enlarged; upon inflation its position could be distinctly made out, with the lesser curvature lying low in the abdomen. The history she gave was that during the past six months she had vomited after almost every meal. She was much run down in health and had lost weight and strength. She had been under the care of various physicians, who had treated her with the idea that the stomach trouble was of nervous origin.

An examination of the stomach contents showed a normal amount of hydrochloric acid. No abdominal tumor could be made out. The right kidney was very movable and could be palpated and fully grasped between both hands. The diagnosis lay between a functional neurosis and a gastropotosis, or perhaps both combined.

Dr. Kammerer did a laparotomy in April, 1900, and found a very marked U-shape of the stomach. The pylorus was found high up under the liver, but presented nothing abnormal. An attempt was made to raise the stomach by shortening the gastro-hepatic omentum, which was about four or five inches long; but this proved a failure, as the ligament was so thin that the sutures would not hold. The lesser curvature of the stomach was thereupon sutured to the lower border of the liver, five sutures of

chromicized catgut being passed through the entire stomach wall, with the exception of the mucosa, and then well into and through the substance of the liver.

For two weeks after this operation the patient did very well; then the vomiting and pain recurred. Nothing more was done until November, 1900, then the abdomen was again opened and a posterior gastro-enterostomy performed with Murphy's button. The stomach was found adherent to the lower surface of the liver. This operation has relieved the patient up to the present time, although she still vomits when she is indiscreet in her diet.

Dr. Kammerer said he regarded this case as one of gastrop-tosis in a neurotic individual, as the gastrop-tosis alone would hardly account for the frequent and severe vomiting.

DR. CHARLES N. DOWD said that two cases had come to his notice in whom pyloric tumors had subsided, as in the first case presented by Dr. Kammerer. One of these was a man of forty, who had suffered from attacks of severe epigastric pain, vomiting, and occasional hæmatemesis for eight years; he had become much emaciated. When admitted to the General Memorial Hospital he was in a very feeble condition, and an operation was done as a last resort. On opening the abdomen, a firm tumor of the pylorus was found about as large as a hen's egg, pushed behind the ribs in such a way that it was not possible to feel it from outside. There was no evident lymphatic involvement, but, on account of the patient's condition, removal of the growth was not to be considered, and a posterior gastro-enterostomy was done and the abdomen closed. Seven weeks later the man's condition had so far improved that the abdomen was again opened with the idea of removing the tumor, but it was found to have disappeared. There was still a slight thickening about the pylorus, but not enough to warrant a pylorotomy. The patient remained in perfect health for a year or more, but subsequently developed a cancer of the pylorus which proved fatal. The course of events had apparently been, first, periodical attacks of gastritis with ulceration and inflammatory thickening about the pylorus; at the time of operation the pylorus was almost, if not quite, occluded by this thickening.

After another exit was made for the stomach contents this thickening subsided; but a carcinoma developed at the site of the ulceration, as occasionally occurs in the stomach and elsewhere.

The specimen from the other case to which Dr. Dowd re-

ferred was seen at the Hamburg-Eppindorfer Hospital last summer. In that instance a gastro-enterostomy had been done ten years before for the relief of obstructive symptoms, which were found to be caused by a growth of the pylorus as large as a hen's egg. The patient remained well for ten years, and then died of something else. At the autopsy it was found that the pyloric growth had completely disappeared. The old gastro-enterostomy opening had remained patent since the operation, and the contents of the stomach had passed out that way as well as by the natural opening through the pylorus.

DR. ROBERT H. M. DAWBARN said that in the latest edition of Gray's "Anatomy" the normal capacity of the stomach was given as, in the male, up to one gallon. The presence or absence of gastroptosis should be determined by inflation by air and not by water, inasmuch as the weight of so much fluid, unless the patient lay entirely recumbent, would drag the stomach down below the level of the navel. Eight pints of water weigh about eight pounds.

DR. CHARLES L. GIBSON said that about two years ago he saw a very convincing article by Czerny recommending gastro-enterostomy in severe cases of ulcer of the stomach. The good results of operative interference in these cases were attributed by the writer to the rapid disappearance of the stomach contents and their reduced total acidity. Physicians who treat this class of cases have been very reluctant to indorse this operation, although they have nothing better to offer. In view of the fact that gastric ulcer is usually not very amenable to medical treatment, its cure by surgical interference is worthy of serious consideration.

DR. F. LANGE reported a case of posterior gastro-enterostomy with Murphy's button in which the button failed to escape, and, as its opening was not sufficiently large for the passage of food, he was compelled to reopen the abdomen some weeks after the primary operation. He found that the failure of the button to become dislodged was due to a constriction of the tissues at the point where the two halves of the button were joined. He attributed the accident to the thickness of the tissues at that point. The patient made a good recovery from the operation, but died four months later from secondary carcinoma.

DR. DAWBARN said he wished to place on record a recent fatal case which he had operated on about three weeks ago. The operation was for a cholecystenterostomy with the Murphy but-

ton, and the patient's death was due to the fact that when the button became loose leakage occurred around it. His colleague, Dr. Bodine, recently had a death from the same cause, at the Polyclinic Hospital, in a simple end-to-end anastomosis of the small gut. In each of these cases Lembert stitches were also taken; but the pressure-necrosis whereby the button loosens itself proved more extensive than was safe, and, as Nature did not throw out a heavy exudate of plastic material to cover this defect, the leakage resulted. The speaker considered the button desirable for gastric work, also in a few instances of gall-bladder surgery; but has no use for it in bowel anastomosis, considering it to have several serious disadvantages.

DR. KAMMERER said the capacity of the stomach in his first case was between three and four quarts: it was estimated by the quantity of fluid that the patient could hold on slow introduction with the stomach-pump without regurgitation.

The speaker said that in all his cases of posterior gastro-enterostomy he had employed Carle and Fantino's modification of applying the Murphy button, and found it very satisfactory. The stomach walls are very thick, and if a purse-string suture is used we are apt to get an uneven surface, the result being that in certain parts between the two constricting rings of the button the tissues will be firmly compressed, whereas in other parts there will be no pressure. In the case reported by Dr. Lange the failure of the button to become dislodged was perhaps due to this uneven pressure at different points between the two sections of the button. Dr. Kammerer said that in his twenty-four cases the button had been passed in all excepting two. His experience with posterior gastro-enterostomy had been so much more favorable than with the anterior operation that he was at a loss to account for the different experience of others, as Mikulicz, who had again returned to the anterior operation.

Dr. Kammerer said that in several cases of carcinoma of the pylorus where he did a gastro-enterostomy at the first sitting, and then waited five or six weeks before undertaking to remove the growth, in order to give the patient a chance to recover, he had found it impossible to do so on account of the changes which had evidently taken place in the growth during the brief period that had elapsed since the primary operation was done. The tumor seemed to have spread considerably in the interval, per-

haps due to the adhesion which had formed, and the cases did not seem any more to lie within the range of radical surgical interference. Czerny, he thought, has reported similar experiences.

REMOVAL OF THE TESTES AND SEMINAL VESICLES FOR TUBERCULOSIS.

DR. P. R. BOLTON presented a young man, twenty-four years old, who was admitted to the Hudson Street Hospital about six weeks ago. He was suffering from a tuberculous epididymitis, with involvement of both testes, vasa, and seminal vesicles. The testes were immediately removed, and the vas deferens divided just above the point where it turns about the ureter. This operation was done through an incision in the groin, and three weeks later, after this wound and the large scrotal incision had healed, the seminal vesicles were removed according to the method recommended by Dr. Fuller. The patient was put in the knee-chest position and a horseshoe-shaped incision made in the perineum; then the attachment of the external sphincter was cut off, the triangular ligament divided, and the rectum pushed out from the prostate. The seminal vesicles were then readily accessible and removed without any trouble.

Dr. Bolton said that the vas on each side broke off near the ureter, so that probably an inch or more was left behind. In future, the speaker said, he would prefer to do both the castration and the removal of the seminal vesicles at one sitting.

In reply to a question, Dr. Bolton said that the method which he had referred to as Fuller's, the external incision, was practically identical with that of Kocher and Zuckerkandl. The advantages of it are that it gives the operator plenty of space, hæmorrhage is easily controlled, and it is not necessary to have any instrument in the urethra.

AN OPERATION FOR SADDLE NOSE.

DR. F. W. GWYER read a paper with the above title, for which see page 268.

DR. L. W. HOTCHKISS inquired whether the method described by Dr. Gwyer would be applicable in cases of saddle nose due to syphilis, with extensive destruction of the bony and soft tissues.

DR. GWYER replied that in one of his cases, and possibly two, the deformity was due to syphilis.

DR. F. LANGE said it would be interesting to see whether the good results of this method would be permanent.

DR. DAWBARN said that the method described in the paper of the evening was ingenious, but since it required a skin cut, and necessarily a scar in a conspicuous region, he considered it less advisable than another plan about to be mentioned. He said that at a meeting of the Society some months ago he presented a naval officer upon whom he had operated a year previously for a very marked deformity of the nose,—so marked, in fact, that it stood in the way, as he believed, of his promotion. The deformity—almost entire absence of the nasal bridge—was rectified by the introduction of a piece of gutta-percha, which was first moulded by aid of boiling water to the right shape, and then, having been chilled into hardness again, slipped into place through a cut within the nostril, with no external incision whatever. The result in this case, the speaker said, and in about ten others where he had resorted to it, was perfect as well as permanent, a few having been several years in place. The only after-treatment necessary is the application of a strip of surgeon's plaster across the face, to steady the new bridge for a few days.

The use of gutta-percha for this purpose is not new, but, so far as the speaker was aware, its employment without any skin-cut is novel. Of course the skin has to be freed from the bone and well up to the eyebrow level, and nearly out to the infra-orbital foramina, through the incision within the nostril, and before the new bridge is slipped into place. Occasionally a cut must be made in the other nostril, too, to accomplish this. Then a long strip of sterile non-absorbent gauze is packed in, to check bleeding, for ten minutes or so, which is then removed and the bridge substituted. Of course the interior of the nose on both sides is first cleansed, the hairs clipped away, and a packing of boric gauze introduced; this gauze remains in place during the operation, and for a day or two later.

In two cases there was some brief suppuration, but the drainage was good, and it did not prevent a final excellent result.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, February 4, 1901.

The President, DE FOREST WILLARD, M.D., in the Chair.

THE BEST INCISION IN OPERATIONS FOR MAM- MARY CARCINOMA.

DR. WILLIAM L. RODMAN read a paper with the above title, for which see page 135.

DR. NEILSON agreed with the author that the Warren incision offers a very simple solution of a difficulty which all have to encounter more or less often in closing the enormous gaps frequently left by the removal of large mammary growths. The flaps are so easily moved and brought into apposition, it is a wonder that the plan was not thought of sooner than it was.

DR. G. G. DAVIS regretted that he could not state that he had always found it easy to close these wounds. As regards the procedure of Warren, he had used it on several occasions, placing the incisions, however, perhaps a trifle lower rather than extending them so far backward. In spite of the comparative ease with which the wound could be closed by means of Warren's method, it seems that Dr. Rodman had still found it desirable to add another incision to it, so that it shows that, in order for it to be efficacious, the undermining of the skin must be very extensive.

As regards methods of operating, he did not think, with some, that the hundred odd hæmostats which are used by many in these operations were entirely useless. In fact, it was his practice to gather up all the hæmostats he possessed or could beg or borrow, and he found that he could put them all to profitable use.

The blood, of course, comes from various vessels, largely according to the methods of operating. If the surgeon goes in above, he will get the acromial thoracic artery at the upper outer

corner of the wound; but the blood that comes from that region is not the only blood that troubles the operator; some of the blood comes from the anterior intercostal arteries, especially the second, third, and fourth branches of the internal mammary.

As regards the method of operating, after making his incision largely in the way that Halsted does, and raising the skin, he simply takes the handle of the scalpel, inserting it at the supraclavicular joint, between the clavicular and sternal portions of the pectoralis major muscle, and splits it clear out to the humerus; introducing the finger in that cleft, it is separated downward from the sternum, clamping the vessels on the side of the tumor and as they come from the intercostal spaces. Then, having loosened it from the sternum, it is turned outward and the pectoralis minor muscle divided. Then, as the apex of the axilla is exposed, prepare the vessels downward and outward, cut off the attachment of the insertion of the pectoralis major muscles, and then work along the subscapular vessels downward and backward to the scapula. Having detached the mass of the tumor from the side of the chest, he sweeps everything from above downward and removes it. Operating in this manner, a large number of hæmostats can be put to good service.

DR. JOHN B. ROBERTS said that he was particularly struck with the early date at which Dr. Rodman was able to discharge his patients with the wounds practically healed. He did not, as a rule, cover in the wound by a plastic operation, because it is possible usually to cover nearly the entire wound by means of strong sutures drawing the edges of the skin together. The integument should be loosened from the underlying structures by undercutting it. He had occasionally made crescentic flaps at the sides of the excision wound and used them to aid in covering the raw surface. He always raised a triangular flap in the supraclavicular region and removed the fat and lymphatic nodes before beginning the operation proper. The entire breast and both pectoral muscles are then removed and the lymphatic nodes under the clavicle are extirpated. The fat and lymphatic nodes in the axilla are similarly removed. In making the triangular flap above the clavicle, he made the point of the triangle towards the acromion. If the point of the flap projects towards the middle line, the skin at the apex nearly always undergoes dry gangrene, because its arterial circulation is interfered with. He would be glad to know whether

Dr. Rodman always removed the supraclavicular glands, and whether he excised the pectoral muscles. He looked upon these two steps in the operation as practically essential, if the surgeon is to give the patient the very best chance of non-recurrence of the malignant disease.

DR. RODMAN answered that it was not his practice to go into the neck unless the glands were visibly enlarged; and he would say further that he had never felt very optimistic about this part of the operation. If there is marked and extensive involvement of the supraclavicular glands, he questioned whether these cases were operable, since, if the supraclavicular glands were involved, the mediastinal glands would also, as a rule, be implicated.

As to the statement made by Dr. Davis, it is true that it was necessary to make this curve—the Y incision—above as well as below, and modify the operation to that extent; but it must be remembered that the case was a very unusual one,—a recurring growth with a large amount of skin infiltration. He had never seen so large a wound. In ordinary cases, it would not be necessary. In the other cases it is very easy to cover a large wound by making an inverted Y below. Dr. Warren, in a personal communication, stated that very frequently he only made one curve instead of two, and he is able to cover most of his wounds with it; two flaps will be necessary if the tumor is large and the space great.

In regard to the question of time, the colored woman left the hospital on the twelfth day. She was operated on the 19th of December last, and left on the 1st of January. She could have left earlier, if she had not had ether pneumonia. The white patient could have left on the seventh or eighth day very easily, but she had postoperative mania beginning thirty-six hours after operation, when she was found walking around the ward at midnight. It was thought, therefore, better to detain her in the hospital from twelve to thirteen days. But she could have left on the seventh or eighth day easily, as her mental symptoms had disappeared and the sutures were all removed. This was not an extensive wound, as in the first case, and the union was firm in a week. He had had cases who had taken a railroad journey of two or three hundred miles a week after operation. He rarely failed to secure primary union, recalling but one such failure in five years. Mammary wounds unite quickly. He added as to the frequency of

cancer of the breast in the colored race, there had been for many years a belief on the part of Southern surgeons that cancer of the breast was more rare in the negro, but that impression is fast passing away. It has been shown very clearly that the colored race suffers quite as frequently, if not more so, from cancer of the breast and uterus than the whites. He was convinced himself that mulattoes were more prone to cancer than the whites, as they inherit the weaknesses of both races and the strength of neither. He had encountered relatively as many cases of cancer of the breast in the colored race as he had in the white. Reference to the Louisville City Hospital records for thirty years, also the records of the City of Louisville Health Department, convinced him of this fact. There were more negroes dying from cancer of the breast and uterus in proportion to the population than whites.

TRAUMATIC THORACIC ANEURISM.

DR. DE FOREST WILLARD read a paper with the above title, for which see page 143.

DR. D. D. STEWART said that he had been interested in this matter since 1890, when he did his first operation, and, as he had done quite a number since, naturally he had been able to draw some deductions concerning the best technique to employ, and he would speak in a general way as to the technique of the operation.

Almost invariably, before wiring, he introduced a fine cannulated needle to assist in determining the thinnest part of the sac wall, and that least protected by clot. He preferred to introduce his needle and wire where the sac was least protected. He did this at the time of operation, or shortly before. He not only punctured before, but subsequent to the operation. He had been very much interested in determining, a short time after the operation, the difference between the depth to which he had to introduce his needle, before spurting of blood occurred, prior to the operation and subsequently. In some cases the difference had been very marked indeed. In one instance, the specimen of which he afterwards showed before the College of Physicians (the operation had been done three and a half years before death, which had resulted from another ailment), needling showed a sac wall scarcely over two lines in depth, at the point of puncture, unprotected by clot. (See *American Journal of the Medical Sciences*, August, 1896.) Four weeks after the operative procedure, "a needle of quite large

calibre was thrust into the sac to a depth of two inches in several situations, in which, at the time of operation, blood spurted at its introduction when apparently only beneath the skin. The needle in this second attempt was found to firmly engage the clot, though thrust perpendicularly up to its hilt in the sac. It could not be circumducted save with effort, and escape of even a drop of blood at any depth did not occur; nor was the needle or wire (which last it had been attempted to reinsert through the needle) blood-tinged when withdrawn. This beautifully demonstrated the solidification of the aneurism." This case was one of very large innominate aneurism, concerning the specimen of which Dr. John Ashhurst made the following remarks: "It shows that the cavity of the sac was as completely obliterated by the contained clot as it could have been by either the Hunterian or the Amylian operation; in fact, as far as this part of the artery is concerned, the circulation was as completely obliterated as it could have been even by extirpation of the whole aneurismal sac." (See *Transactions of the College of Physicians*, Vol. xix, 1897, p. 43.)

He had never had ill results from needling or wiring aneurisms. He adopted antiseptic precautions. His first case was a very large aneurism, involving both the thoracic and abdominal aorta, which had eroded the bodies of several dorsal vertebræ. The sac was twelve inches in oblique measurement. In his later operations he employed as a medium for passing the wire and subsequent electrolysis insulated gold needles, of rather small calibre, and made of gold insulated with porcelain.

The wire that he employed was either gold or silver. He had been using gold wire in preference to silver because he could have it more tightly drawn. It is important that the wire that is used shall assume spiral coils, one that may not easily be deflected by loose coagula in the sac. He used wire drawn to twenty-eight or thirty gauge. Silver wire he had used on a number of occasions, but he preferred gold wire. He had never introduced more than fifteen feet at one operation. It is of the utmost importance that there should be a relation between the amount of wire introduced and the size of the aneurism treated. There cannot be expected subsequent contraction of the aneurism to the extent desired, that is, obliteration of the sac cavity, if too much wire is introduced. It is extraordinary the amount of wire that some of the earliest operators used, both without the employment and with

the employment of galvanism. For instance, in a case operated upon by Roosevelt, he introduced 220 feet; and in one by Abbe 150 feet were introduced subsequent to the passage of 150 feet of horse-hair. He introduced two or more insulated needles, and passed the wire in equal quantities through each. By this means the whole interior of the sac is better reached by a smaller quantity of wire. If the wire is passed through but one needle, it may go in but one direction, being deflected by loose clot, and not reach so well all parts of the cavity, and none of it tend to lie against the sac wall itself, even if portions of this are unprotected by clot. An important result which may follow contact of portions of wire with the unprotected sac wall is the formation of wall, or white, thrombi, due to the electrolytic action of the current on the endothelial lining of the sac wall. White thrombi may be expected to later form here by the deposition of leucocytes from the abraded vessel wall and from the blood-stream. From these thrombi organization would tend to proceed to the red thrombi formed about the wall within the aneurism. Thus may be obtained the results of Macewen's operation by needling, plus that obtained by wire and the electrolytic action of the galvanic current on the contained blood.

If it is intended to introduce a definite quantity of wire through but one needle, and in process of passing the wire kinking occurs, a second needle should always be at hand for the passage of the additional quantity, and this needle is better introduced in a portion of the sac somewhat remote from the first needle. Of course the wire from the various needles should be all joined to the same, the *positive*, pole. It should be a rule that has no exception, to use only the positive pole within the sac. The reason for this he had entered into very fully in his various publications on this subject. If the negative pole is connected with the needle, the clot is always soft and friable. Bubbles of hydrogen tend to accumulate about the negative needle and assist, also, in softening the clot. If the negative pole is used after the positive, which has sometimes been done, it will tend to dissolve the already formed clot. Although he had pointed this out again and again, yet this point is not often attended to by operators.

Concerning the amount of current strength, 120 is the highest amperage he had used. He had continued for an hour and a half with a current strength of sixty-five milliamperes. A large cur-

rent strength should not be continued too long. He had noticed in several cases operated upon that visible signs of coagulation in the sac appeared rather early, and then were not so marked after an increase in the current strength which had been continued for a longer period. It seemed as if coagulation had occurred, and that the coagulum tended to again become softer. He did not now, as he once did, favor the long application of the current, nor of the very high current strength that he at first used. He was inclined not to use a greater current strength than sixty to eighty milliamperes, and not to continue this for too long a time. The current is started from zero and gradually run to the number of milliamperes desired, say eighty, and this is reached in about ten minutes. The current is here maintained for nearly the requisite time, and then gradually diminished to zero. It is of course unwise to turn on a great degree of current suddenly. It has occurred to him on several occasions that the patient had accidentally moved from the large negative plate, thus interrupting the current, and before the current could be switched from the battery it had been closed by his again lying against the plate. Nothing had happened as a result of this, but of course it was very undesirable that it should occur. He used as the indifferent or negative pole a large clay pad, upon which the patient commonly lies. If desired, in operating on the thoracic aorta anteriorly, this pad may be laid upon the abdomen.

As to the use of iron wire, it has been advocated, but he did not recommend it. Some ten years ago he made experiments as regards the effects of different current strengths passed through iron wire, and he found that, as mentioned in his first paper on this subject (*American Journal of the Medical Sciences*, October, 1892), a large amount of detritus always results from the passage of a galvanic current of even low amperage through iron wire. An amount of ferric oxide and chloride is thus formed, which might result very injuriously through the passage of some of this detritus as emboli into the blood-stream.

He regarded it as of importance that the patient should be prepared for the operation. His physical condition should be as good as possible. It is of the utmost importance that the heart should not be overacting, and that the blood-pressure should be low; in other words, that the condition should be favorable for the formation of clot within the sac. It is desirable that the pa-

tient should be thoroughly reassured prior to the operation that little or no risk attends the procedure, and that practically no pain is experienced. He administered morphia hypodermically prior to the operation, and if the blood-pressure was very high, aconite was given a few days before the operation. In the last case he operated on a few months before, good immediate results were apparent, although, despite the use of morphia and aconite, the heart's action could not be quieted. There was a pulse of about 180 during the operation, and yet the impulse in the sac became less marked as the current passed, and the aneurism more firm. This immediate effect from the operation had been noted by himself and others in several of his cases, and there seemed no doubt that the coagulation does occur during the operation through the passage of the current. In one of his cases that he operated on for Dr. Salinger a number of years ago, at the Philadelphia Hospital, the immediate result of the passage of the current was remarkable. This was demonstrable to all present. The needle had been introduced into the weakest part of the sac, and fell unless upheld, so utterly unprotected was this part of the sac by clot. Towards the end of the electrical session the needle was supported by the newly formed clot, and remained firmly perpendicular.

He never made an incision into the skin for the introduction of the needle, which he inserted by gentle pressure and spiral manipulation into the sac wall. Were he to use a cannula, and make a primary incision through the skin, he should be afraid to attack the weakest part of the sac wall. Before the wire is introduced, the blood spurts from the needle, and continues to leak during the passage of the wire until the current is turned on. As soon as a few milliamperes of the current have passed, bleeding ceases, and does not recur. Concerning the removal of the wire, he cut the wire close to the needle, and then simply spirally twisted his needle, making counter-pressure with the fingers until the needle was withdrawn from the sac, pulling the wire out a little. The wire was then close to the skin, and the skin pulled forward over the wire, after which the site of puncture was sealed with iodoform and collodion.

In answer to a question as to the greatest length of time that the patient has lived after such a procedure, Dr. Stewart said that one of his cases lived three and a half years, and died from an affection distinct from the aneurism. In this case, that operated

on for Dr. Salinger, before referred to, the cure was complete. The aneurism was completely solidified. It was of this case that Dr. Ashhurst made the remarks referred to.

DR. DE FOREST WILLARD added that he had been concerned by the puncture at the thin portion of the sac. When a surgeon feels an aneurism of the size of a child's head pulsating directly underneath the skin, he naturally hesitates to make a puncture at that point, lest he weaken the sac and hasten rupture. It was for this reason, also, that he feared, if he did not thoroughly insulate the wire, that there might be destruction of skin and subcutaneous tissue by the current of electricity that would open the aneurism a few days later and cause a rupture. In removing the cannula he was careful to push the wire down thoroughly underneath the skin and into the sac, so as not to have the wire lead the blood out from the aneurism through the skin, or permit infection of the sac, along the wire from without. The point of puncture was supported thoroughly with collodion and aristolated gauze. There was no bleeding at the time of the withdrawal of the cannula, and there had been no bleeding since. That point of the sac is now apparently stronger than several other areas. The weakest point at the present time is under the axilla; yielding, he feared, was extending in that direction. He proposed, in the course of one, two, or three weeks, if the patient was as well as he was then, to repeat the operation, and endeavor to secure more clot in the outer and upper portion of the sac.

Stated Meeting, March 4, 1901.

The President, DE FOREST WILLARD, M.D., in the Chair.

LEFT-SIDED CÆCAL HERNIA.

DR. JOHN H. GIBBON reported two cases of left inguinal hernia in which the cæcum was found in the sac. For the account of these cases, with critical remarks by the reporter, see page 155.

CÆCAL HERNIA, WITH VOLVULUS OF ILEUM.

DR. FRANCIS T. STEWART said that he was indebted to Dr. Martin for the privilege of operating on the following case, which

he reported with a view to swelling the statistics of cæcal hernia collected by Klein, Brieger, Bacardi, and Gibbon; as a contribution to the study of volvulus associated with hernia recently made by Knaggs; and to establish a third class, that of cæcal hernia with volvulus, two other cases having been recorded, one by Da Costa (*ANNALS OF SURGERY*, Vol. xxix, p. 280), a right inguinal hernia consisting of cæcum, most of the ascending colon, and a twisted ileum, and one by Catellani (*ANNALS OF SURGERY*, Vol. xxviii, p. 708) in which, besides the small intestine, the cæcum, ascending, and transverse colon descended through the left femoral ring, the whole mass being circumgyrated, the neck of the twist lying within the abdomen.

A. B., aged fifty years, laborer, entered the Pennsylvania Hospital, December 25, 1900. For eight years he had been harassed with a right-sided inguinal hernia, at first small but gradually attaining a large size. Two days before admission, the rupture became irreducible and exceedingly painful. There were retching, vomiting, and absolute constipation. The patient was thin but muscular; the face anxious, drawn, and covered with sweat; the abdomen rigid and tympanitic; the temperature normal; the pulse 140 and thready, and the respirations 40 and entirely thoracic. In the right inguinoscrotal region was a markedly tender, tense, and tympanitic tumor about the size of two fists, irregularly ovoid in shape, and extending from midway between the anterior superior iliac spine and the pubes to the bottom of the scrotum. After but a feeble attempt at reduction, operation was immediately undertaken. The sac was thick, vascular, contained no fluid, and was easily separated from the spermatic cord; a constriction in its neck was responsible for the strangulation. The scrotal portion contained about one foot of ileum, twisted 130 degrees from right to left; just without the external ring lay the caput coli and appendix completely surrounded by sac. Both large and small bowel were deeply congested, but the endothelium was intact, and moist heat with relief of the constriction quickly restored them. The internal ring readily admitted three fingers. The appendix was not excised. The operation was completed after the method of Bassini. Strychnine and digitalis were administered hypodermatically, and one quart of salt solution was injected into the left median cephalic vein. The bowels moved within twenty-four hours, the stitches were removed on the sixth

and ninth days, and the patient left the hospital on the twenty-seventh day with a firm scar.

The salient points in this case are that the small bowel descended first, and by its twisting and traction pulled down the large bowel, tending to corroborate Gibbon's view that cæcal hernia is due to the traction of a pre-existing hernia of the ileum, that the patient presented evidences of a peritonism out of all proportion to the condition found at operation, that the sac was complete and contained no fluid, although not adherent to the bowel, and that the hernia was exquisitely tender, which might be explained by the presence of the appendix.

EXCISION OF INTESTINE FOR ACUTE OBSTRUCTION OF BOWELS FOLLOWING STRANGULATED FEMORAL HERNIA. OPERATION.

DR. THOMAS S. K. MORTON reported the following case. M. W., a single woman, aged thirty-one years, was seen December 10, 1900. She presented symptoms of strangulated femoral hernia on the right side. It had been present for several years, but had never become irreducible until some twelve hours previously. Then she lifted a heavy weight and experienced much pain in her rupture. Two vigorous efforts had been made to effect reduction, —one under ether. Operation was performed. About six inches of dark, small intestine were found in the sac, as well as a considerable amount of omentum and prune-juice-colored serum. The intestine was cedematous and, in spots, had lost its lustre. Warm applications having markedly improved its circulation as evidenced by brightening color, it was returned to the abdomen. The omentum was bruised and infiltrated with small spread-out clots, so it was excised. Bassini's radical closure of the canal was then employed. She made an ideal recovery, the bowels moving spontaneously on the second day. But two weeks afterwards she suffered from severe pains about the umbilicus for several hours. This was repeated once or twice at intervals of two days and then disappeared. She went to her home at the end of the third week, and continued in apparently perfect health for some ten days. Then she was seized with violent symptoms of obstruction of small intestine which lasted for twelve hours. Upon the third day following another attack almost as violent came on, and the woman was returned to hospital for abdominal section.

This second operation discovered the portion of bowel that had been strangulated condensed into a very hard, fibrous mass about two inches long and firmly adherent just below the femoral ring in the pelvis. It was dissected and torn off with extreme difficulty. The lumen of the bowel at the site of constriction was torn open during this procedure. The calibre of the gut through the cicatricial mass was not greater than one eighth of an inch. The whole diseased portion of gut as well as one inch of healthy bowel on each side were excised. Downes's forceps were employed in this case and gave satisfaction. Recovery from the operation was again ideal, save for a saprophytic abscess in a portion of the wound, which probably arose from contamination by the torn portion of bowel. She has remained in perfect health up to the present time, seven weeks after.

TRANSACTIONS OF THE CHICAGO SURGICAL SOCIETY.

Stated Meeting, April 5, 1901.

The President, CHRISTIAN FENGER, M.D., in the Chair.

INTERSCAPULOTHORACIC AMPUTATION.

DR. S. C. PLUMMER, JR., presented a man, aged sixty-seven years, who was run over by a very heavy locomotive at 10 A.M., November 21, 1900, sustaining a crushing injury of the right upper extremity. At Mercy Hospital the interne found the extremity attached to the body merely by a few bridges of crushed skin, which he cut with a scissors, removing the extremity along with the coat-sleeve. Examination of the wound showed three inches of the upper end of the humerus remaining. The soft parts were torn and crushed to a considerable distance above the shoulder-joint. Patient suffered from severe shock. A wet formalin dressing was applied to the wound, and patient was treated for shock, among other means receiving two quarts of normal salt solution hypodermically.

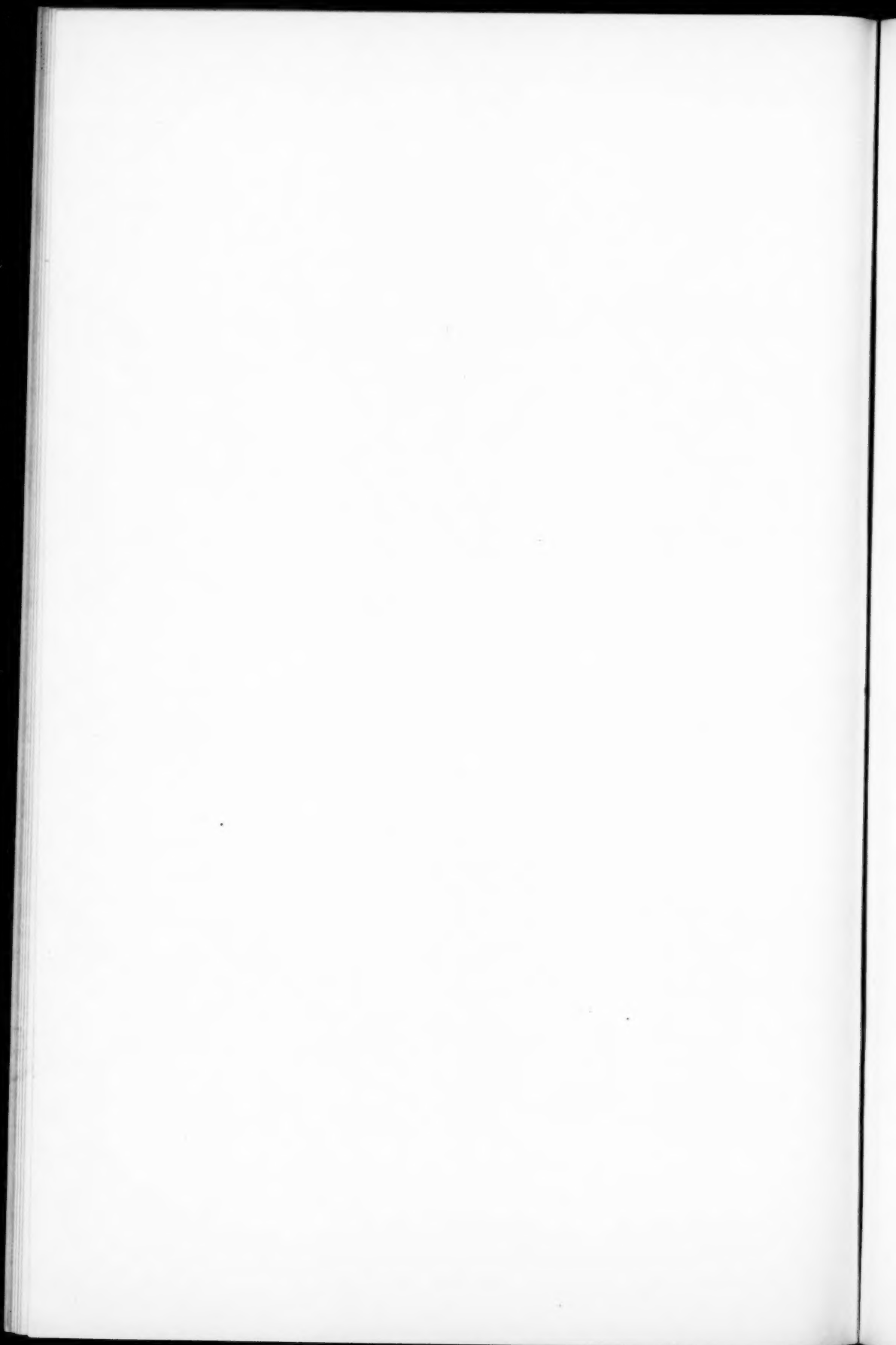
November 22, at 8.30 A.M., almost twenty-four hours after the injury, the patient having recovered from shock, an interscapulothoracic amputation was performed, the technique of Kocher being followed in the main. Incision along upper surface of clavicle from near sternal end to outer end. Division of clavicle with chain-saw at outer border of sternocleidomastoid muscle. The outer portion of the clavicle was removed by disarticulation at acromioclavicular joint. Ligation of third portion of subclavian vein, also of another large vein lying between the two, probably the cephalic running higher up than usual. Anterior flap now cut by incision from middle of clavicle to lower border of axilla close to thorax. Pectoralis major cut through somewhat outside its middle. Pectoralis minor separated from coracoid



FIG. 1.—Interscapulothoracic amputation for crushing injury, November 22, 1900. Photograph taken seven days after the amputation, showing liberating incision below the wound.



FIG. 2.—Interscapulothoracic amputation for crushing injury, November 22, 1900. Photograph taken seven days after the amputation, showing liberating incision in front of the wound.



process. Brachial plexus divided high up. Outer part of trapezius separated from spine of scapula. Latissimus dorsi cut through at posterior wall of axilla. Scapula now turned out and all muscles connecting it with the trunk severed from its borders; also the remainder of the trapezius separated from the spine of the scapula. All the operating thus far was done from in front. A skin incision was now made from behind, connecting the two ends of the anterior incision, thus allowing the scapula, all muscles connecting it with the upper extremity, the remnant of the upper extremity, and the skin above the shoulder to be removed.

The hæmorrhage was slight, not more than a dozen vessels being caught up, and not more than half a dozen ligated. Silk ligatures were used for the subclavian vessels, catgut for all others. The clavicle and scapula were found not to have been injured. Drainage by one large rubber tube, inserted through a special opening postero-inferiorly. The flaps had been cut rather short, owing to the poor condition of the skin. In closing the wound tension was relieved by two liberating incisions, one in front of and one below the wound. Patient stood operation well, and was given two quarts of normal salt solution hypodermically immediately after its close. He was delirious for several days. A very small portion of the flap sloughed. After the first week, progress towards recovery was uneventful.

GUNSHOT WOUND OF THE ABDOMEN.

DR. PLUMMER also exhibited a man, aged twenty-five years, who was admitted to the service of Dr. Wm. E. Morgan, in Mercy Hospital, August 29, 1899, suffering from a gunshot wound of the abdomen, produced by a 22-calibre bullet from a practice rifle. The point of entrance was in the left nipple line just below the margin of the ribs, and the bullet ranged transversely across the abdomen. There was no point of exit. Ether was administered, and an incision made in the median line. The recti muscles remained rigid even when the anæsthesia was pushed to the danger-point. This made it difficult to handle the intestines, as it required an undesirable amount of force to replace the coils which had been drawn out for examination or operation. Seven perforations were found in the small intestine, from the lowest of which liquid fæces escaped. The infected area was cleansed by sponging. None of the perforations was extensive,

and each was closed by a continuous silk Lembert suture. The uppermost perforation was in the first part of the jejunum, and the bowel at this point was distended with blood. Difficulty was experienced in bringing the abdominal wound together, owing to the rigidity of the recti muscles. The patient soon developed signs of peritonitis, also a severe purulent bronchitis. He coughed incessantly, and became the picture of a typical case of general peritonitis with characteristic facial expression, temperature, pulse, tympanites, and vomiting. The wound suppurated. At first he was given calomel and salines, later morphine. For two weeks he remained in a precarious condition, but eventually recovered. The skin over the abdominal wound united firmly, the deeper portions of the wound but partially.

On December 3, 1899, patient again entered the hospital, having a hernial protrusion in the median line the size of a fist. Dr. Morgan operated upon him. It was found that throughout the greater part of the incision there was no peritoneal, muscular, or fascial union. The omentum spread out so as to line the whole of the cavity containing the hernia. There was no hernial sac, as the edges of the peritoneum remained *in situ* at the margins of the original incision. The omentum was adherent everywhere by its outer surface to skin, fasciæ, and muscle, and was detached with difficulty. Within the peritoneal cavity no adhesions were found, no sign of the pre-existing peritonitis being present. The site of one of the intestinal perforations was recognized by a slight scar, no trace of the suture remaining. A heavy silk suture was passed one and a half inches from the edge of the wound, through skin, rectus muscle, and peritoneum as a tension suture. The wound was sutured by layers with buried silk sutures and superficial silkworm-gut sutures. The patient developed a bronchitis and peritonitis as severe as after the first operation. There were some stitch abscesses, but union was perfect. Present condition: General health good; weight as great as before his accident; long scar in median line of abdomen; no hernia present.

DR. CHRISTIAN FENGER said he could appreciate the difficulties encountered by Dr. Plummer of rigidity of the abdominal wall during the operation, and the fact that it could not be overcome by narcosis. Rigidity of the abdominal wall during these operations played an important rôle, as it was likely to take away the patient's life. He had operated on one patient where this

rigidity of the abdominal wall was present, and in spite of good assistants all the intestines came out, so that it was difficult to replace them. He was certain that at least two patients of his in which this occurred died from shock. Operating for multiple perforations of the intestine produced by a bullet received in civil life was all right, in spite of the experience in South Africa where it had been stated to be doubtful as to whether primary operation on such patients should be undertaken or not. According to the experience of surgeons in the Boer-English war, about as many men recovered by letting them alone as by primary laparotomy. Surgeons from their experience in war should not draw deductions as to the conditions during times of peace, and as far as penetrating gunshot wounds of the abdomen in times of peace were concerned, if the patients could be got at early, and under favorable circumstances, laparotomy should be resorted to. The case of Dr. Plummer proved that surgeons should not abandon early primary laparotomy in cases of penetrating wounds of the abdomen in times of peace, whatever they did in this respect in times of war.

DR. COOPER (by invitation) stated that many of the penetrating gunshot wounds of the abdomen which he had seen in the Transvaal during the British-Boer war were not operated upon, and the mortality was not as large in those as it was in the cases that were operated upon. The wounds were produced by Mauser bullets, consequently there was not the chance for immediate operation that there would be in civil life.

FIBRES FROM THE TENDON OF THE EXTERNAL OBLIQUE MUSCLE AS SUTURE MATERIAL IN HERNIA OPERATIONS.

DR. L. L. McARTHUR made a preliminary report on a method of suturing in hernial cases. In his last five herniotomies he had made use of the fibrous tendon of the external oblique muscle as a suture material instead of using any buried sutures whatever, and his results had been as satisfactory as if he had used catgut or kangaroo tendon. In any one of the hernial operations, whether it be the Bassini, the Halsted, or the Andrews operation, it was customary to expose the external ring, and in some of them to split the external oblique aponeurosis upward and make a new internal ring above. If one will follow the pillars of the ring

(external and internal) upward, he would find that they terminated in the muscular belly of the external oblique. He would also find two or three strands of white fibrous tissue or tendons of muscle fasciculi to each one-eighth of an inch of the tendon. These strands were about four and a half to five inches long in the adult. If one would take the internal pillar, three or four strands, and parallel that edge of the ring until he came to the muscular belly of the external oblique, he would then have a strand which was attached to the spine of the pubes, and which he could separate where it begins to end in the muscle fibre. If the same was done with the external pillar of the ring, he would have a second strand of fibres. In the herniotomies in which he had used these strands, he had found a tendinous material which permitted suturing of the canal, either by the Bassini method or by the imbrication method of Andrews and Girard, so satisfactory that he felt it was a good suture material to bring to the attention of the Society, although the cases in which it was used had only been operated upon some six weeks ago. In all of them primary union had taken place, with the temperature below 99° F. all the time. Usually, when kangaroo tendon or catgut was used, on the second or third day after operation the temperature ranged from 100° to 101°, with considerable induration in the neighborhood of the operation. With this suture material there was no induration and no infiltration.

The question naturally arose, Will this suture hold? Being non-vascular tissue and consisting of only three or four strands in thickness, and one which received its nourishment largely by imbibition, he felt confident that it would live, and had not hesitated to trust to suturing of the edges together, and had found it very easy of performance. If the tissue died, it was aseptic, and would become absorbed as would any other animal suture. If it lived, the result would be to leave white fibrous tissue applied in a direction transverse to that which would tend to separate the fibres in the future. It would then furnish ideal closure of the hernial canal. He had reason to believe that it would live if the experiments of Vulliett in the suspension of the kidney with the tendon of the latissimus dorsi muscle were true that those tendons lived, then it should live here. It had the advantage of not introducing any foreign material. The speaker urged the avoidance of handling the suture graft by tying silk suture to its end, and threading

the silk through needle, by which means it was unnecessary to handle it.

He had started some investigations to determine whether such a tendon lived or became absorbed after being handled in the manner described, but he could not yet make a report on it, but would do so in the future.

Ligature of the neck of the sac was made of the same material. Fixation of the end of the suture is best made by the method suggested by Dr. L. Gumsfelder, *i.e.*, just before the last stitch is taken the tendon is split for about an inch and one end drawn through, then the two ends can be tied together. The adaptability of the same principle to the closure of the muscle-splitting operation in appendectomies, etc., was referred to.

REVIEWS OF BOOKS.

OPERATIVE AND PRACTICAL SURGERY FOR THE USE OF STUDENTS AND PRACTITIONERS. By THOMAS CARWARDINE, M.S. (LOND.), F.R.C.S. Bristol: John Wright & Co., 1900.

This volume is intended, as its author states in the preface, to be a manual of surgery, and occupies a position midway between the compendiums with which we are all familiar and the more pretentious and elaborate works. The author writes in a homely and practical way, and, illustrating his own text, has given us a series of cuts which are rather rude and inartistic, but practical. The chapter on fractures contains a brief account of the essentials in diagnosis and treatment and devices, both new and old, for the retention of the fragments. We are a little surprised to find the "Middlesex" treatment of fracture of the patella mentioned with praise, especially as the statement is subsequently made, with the emphasis of italics, that this treatment takes a year to complete. We think that modern surgery can do better than this in many months. The chapter on ligation of arteries is excellent, and the directions for isolating the individual vessels are clearly stated. Under amputations, most of the modern operations are mentioned, but not a word is said of the modern methods of preventing hæmorrhage in an amputation at the hip-joint. The description of many of the operations is rather an account of what is to be done than instruction in the method of operating. Perhaps the brevity of the book necessitates the adoption of a sketchy style. The concluding chapters contain brief mention of the pathological conditions of the nose, throat, eye, and ear, together with such operative procedures as are usually adopted for their relief.

ALGERNON T. BRISTOW.

DIE TRAUMEN DER MAENNLICHEN HARNROEHRE. By DR. M. A. WASILIEW, Professor e. o. der Chirurgie an der Kaiserlichen Universität zu Warschau. II Theil. Pp. 166. Twenty illustrations. Berlin, 1901. Aug. Hirschwald.

The subjects under consideration in this Part II are abrasions, bites, evulsions, dislocations, fractures, and false passages of the penis. The most that can be said of the treatment of the topics is that they afford a *résumé* of the matter, which, owing to the scarcity of their occurrence, afford but a narrow field for original observation. A little more evidence of the latter in this pamphlet would constitute a fair *raison d'être* for its existence, since many of the standard works by no means neglect traumatic affections of the urethra. The merit of such a brochure is solely literary and valuable for its bibliographic fund, which is enhanced beyond the ordinary by the conspicuous addition of Polish literature.

MARTIN W. WARE.

INTERNATIONAL CLINICS. Edited by HENRY W. CATTELL, A.M., M.D. Vol. I, Eleventh Series, 1901. Philadelphia: J. B. Lippincott Company, 1901.

This volume is devoted to all of the branches of medicine, and contains much of interest and importance. Clinical lectures from a large number of hospitals are reported.

The objection to this sort of reporting is that a large amount of indiscriminate discussion is presented which really has no place in a work of this kind, but which pertains to matters belonging more properly in text-books. Some of it is very elementary. Here is an example of the surgical kindergarten style: "CASE VI. —This patient has a little soft tumor on the face. It has been there for some time. As the skin is not red, it is not inflammatory; it is presumably a cystic tumor, and most likely sebaceous. Such growths are common on the face and still more so on the scalp. If you can, you should always remove these cysts without

cutting into them. Therefore, I cut very slowly down *to* the cyst, but not *into* it," dear children!

Professor Roncali, of Rome, is reported in a clinical lecture upon a case of brain compression from depressed fracture of the cranium. This boy sustained a compound depressed fracture of the skull. He was taken to the hospital in a comatose condition. The surgeon recognized the depression, but sewed up the scalp wound without elevating the depressed fragment. The coma lasted twenty-four hours; then the boy came out of it. The professor says, "Curiously enough, the lacerations healed almost by first intention." Curiously enough, the professor relates all of this with approval, as though it were good surgery. Then began the train of cerebral symptoms which continued for six years,—diminution of intelligence, melancholic disposition, pain in the head, and, finally, epileptic attacks. At last the boy was operated upon and the compression relieved. The author discusses the question as to whether it is better immediately to elevate fragments of bone pressing upon the brain or not, and finally concludes that it is.

Besides reports of clinics, the volume contains a number of formally prepared papers. A very excellent one of these is on the subject of photomicrography by Mr. W. H. Walmsley, who simplifies this subject and brings it within the reach of the ordinary microscopist.

The best feature of the book is its last one hundred pages under the title, "Progress of Medicine," by Dr. N. J. Blackwood, U. S. N. In this part of the book there is a systematic attempt to report the important articles which have been published during the past year. The surgical *résumé* is good; and the author has with excellent judgment and discrimination culled out the best. Had he given full credit to the publications from which articles have been abstracted, his chapter would have been *sans reproche*.

JAMES P. WARBASSE.

THE BLOOD CHANGES INDUCED BY THE ADMINISTRATION OF ETHER AS AN ANÆSTHETIC.¹

A CONTRIBUTION FROM THE LABORATORIES OF THE JEFFERSON
MÉDICAL COLLEGE HOSPITAL.

By JOHN CHALMERS DA COSTA, M.D.,

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AND

FREDERICK J. KALTEYER, M.D.,

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MANY years ago it was asserted that the administration of an anæsthetic has a destructive influence upon the blood. This view was a mere opinion, and was not deduced from well-conceived and carefully performed experiments.

Dr. John Snow believed and taught that an anæsthetic agent suspends the processes of oxidation, and that the essence of the anæsthetic state is suspended oxidation. This view has been advocated in modern times by Richardson, but has of late been entirely overthrown by a recognition of the facts stated by Buxton, that we can produce anæsthesia by hyperoxidation, and that a number of "deoxidizing bodies" are not anæsthetics.

In 1861, Sansom made a report to the Royal Medico-Chirurgical Society, in which he maintained that during anæsthesia quantities of blood-corpuscles are destroyed. He did

¹ Read before the American Surgical Association, May, 1901.

not examine the blood before, during, and after anæsthesia, but made experiments upon blood in test-tubes by adding to it anæsthetic drugs. He found that the addition of an anæsthetic to blood outside of the body destroys the corpuscles and liberates coloring matter. The above method was, of course, inconclusive, could give no positive information, and was, at most, merely suggestive.

In 1869, Dr. J. H. McQuillen (*Dental Cosmos*, March, 1869) made a series of experiments in order to determine the condition of the corpuscles of the blood during the anæsthetic state. He examined the blood of a number of human beings prior to and after the administration of ether, chloroform, and nitrous oxide, and stated that he found no evidence of corpuscular destruction.

In 1890, Mikulicz (*Beilage zum Centralblatt für Chirurgie*, 1890, No. 25) presented the studies of a pupil, Bierfreund, in regard to the amount of hæmoglobin in the blood in surgical diseases, with especial reference to its restoration after the occurrence of hæmorrhage. He mentioned in this paper that the administration of chloroform may reduce the hæmoglobin from 5 to 10 per cent.

In 1893, Garrett and Oliver (*Lancet*, September 9, 1893), as a result of numerous experiments, arrived at the conclusion that anæsthetics, particularly chloroform, deoxidize the blood and also the tissues, and thus induce malnutrition and the formation of quantities of waste products, the elimination of these toxic products causing a severe, and possibly a dangerous or even a fatal, strain upon the excretory glands. Garrett and Oliver also pointed out the fact that a patient under the influence of ether sweats profusely, a process which lowers the temperature, the temperature being also lowered by the evaporation of ether and by depression of the nervous system. In this paper we point out that the sweating which occurs under ether must be taken into consideration in estimating blood changes.

In 1895, one of us (J. Chalmers Da Costa) made an investigation of the action of ether upon the blood, he being at

that time unaware of Mikulicz's observations upon chloroform, or of any other studies of a like sort. The experiments were published in the *Medical News* of March 2, 1895. The blood was examined before, during, and after etherization. Twenty-seven cases were studied; in the majority there was a distinct fall in hæmoglobin. It was also observed that the red corpuscles were often altered in shape, but that they were not diminished in number. The diminution in the amount of hæmoglobin was found to be most marked in anæmic individuals,—an observation which seems to afford an explanation of the reason why operative shock is usually so profound and prolonged in the anæmic. In Da Costa's cases the counts were made by means of a Thoma-Zeiss hæmocytometer, and the hæmoglobin was estimated by the instruments of Gowers and Fleischl. That the fall in hæmoglobin was not entirely due to the hæmorrhage was indicated by the fact that it occurred in some bloodless cases; for instance, an examination of a strictured rectum, the reduction by taxis of an inguinal hernia, and the breaking up of adhesions in an ankylosed metacarpophalangeal joint. It was also noted that ether given as an anæsthetic markedly lowers the temperature. This fall of temperature begins with the anodyne stage, and averages from 1° to 3° F., but may reach 4° or even 5° F. That the fall is not due purely to shock is proved by its occurrence in trivial operations, and by the rapid ascent of the temperature on suspending the administration of the anæsthetic.

Among the conclusions deduced from these experiments are the following:

“ Etherization produces a marked diminution in the hæmoglobin of the blood.

“ The red corpuscles and the hæmoglobin are especially affected in blood previously diseased.

“ Irregular records are due to faulty observation; to the presence of altered hæmoglobin in the blood; to the faulty aberration as to color of a Fleischl instrument or to taking blood before anæsthesia is complete.

“ The white corpuscles show irregular changes which are

not characteristic, and exhibit variations not more pronounced than would be found in the same number of samples of normal blood on different examinations.

“Age does not apparently influence the results.

“The often-quoted observation as to the effect upon the hæmoglobin of shock and hæmorrhage requires enlarged repetition of the experiments upon human beings, before the statements that hæmorrhage causes a great fall in the amount of hæmoglobin, but that shock does not affect it, can be accepted.

“Prolonged anæsthesia profoundly deteriorates the blood and strongly militates against recovery; hence, rapidity of operation is most desirable.”

One or two other conclusions which do not seem to bear upon our present study are not cited.

The above-quoted studies, if correct, indicate that the blood of a patient should be examined before an anæsthetic is administered; and that if marked anæmia exists, or if the amount of hæmoglobin is lowered, the administration of an anæsthetic must be regarded with apprehension. If it is found necessary to employ one, it must be administered by a skilled anæsthetist. As little as possible should be given; oxygen should be administered with it; the surgeon should work rapidly; the patient should be carefully protected from cold, and vigorous efforts to bring about reaction should be promptly made as soon as the operation is complete, or even during its performance. If the amount of hæmoglobin is very low, no general anæsthetic should be given.

Da Costa made no attempt to obtain information as to the lowest amount of hæmoglobin which is consistent with the fairly safe administration of an anæsthetic. Mikulicz estimates it at 30 per cent. for chloroform. He believes that the administration of chloroform when the hæmoglobin is only 20 per cent. will be followed by respiratory paralysis. In three patients that died of operative collapse, Mikulicz found but 15 per cent. of hæmoglobin remaining in the blood.

These views in regard to the deteriorative influence of ether upon the blood have been accepted by some and re-

jected by others. It has been generally accepted that ether causes leucocytosis, which is probably of a toxic character; but its action upon the red corpuscles and hæmoglobin is still a matter of dispute. Von Lerber (*Centralblatt für Gynäkologie*, No. 19, 1897) reports a study of the blood in 101 cases after the inhalation of ether. He asserts that in most instances the hæmoglobin was unaltered. He found leucocytosis, but the red corpuscles were very little changed, either in number or in appearance. He made a spectroscopic study of the urine; but as he was unable to find urobilin, he concludes that ether does not exert any harmful influence upon the blood, and does not set free hæmoglobin. The belief that because urobilin is not discovered in the urine, none is set free in the blood, is, to our mind, not warranted by conclusive observations. Von Lerber points out that the more prolonged the anæsthesia the more marked is the leucocytosis.

Oliver (*Lancet*, June 27, 1896) says that observations should be made upon animals, in order to determine whether normal red corpuscles are affected by ether. He believes that observations made before, during, and after operations are entirely unreliable, because the operation, whether or not it is accompanied by bleeding, disturbs the composition of the blood. Oliver made a number of observations upon rabbits, keeping each animal under the influence of the anæsthetic for one hour. He found the average blood decimal to be 1.1 before anæsthesia and .98 after anæsthesia; during anæsthesia the corpuscles appeared to be normal, and there were apparently no injurious after-effects. He says that this indicates that ether does not affect normal red corpuscles, but admits that it may affect those that are diseased; and he is quite sure that the resisting power of the stroma of the corpuscles must vary under the influence of ether.

Dudley W. Buxton (*Lancet*, February 1, 1896) says: "In every case, blood removed from the body and shaken with an anæsthetic shows destruction of the corpuscles and reduction with pouring out of hæmoglobin; and it would also appear that a similar, if less marked, phenomenon occurs in the body." Through some observations which he has made, Buxton has become persuaded that there is a decided diminution in hæmo-

globin when an animal is under the influence of ether, chloroform, or nitrous oxide. He says: "It is, however, not improbable that factors other than the anæsthetics may be found at work in bringing about this result. The combination or association between the gaseous anæsthetics or vapors and the constituents of the blood must be a loose one, since in their presence oxygen is displaced. Were they to form combinations as stable as that which carbonic oxide establishes, not only would the anæsthetic displace the oxygen, but it would render impossible the re-formation of oxyhæmoglobin; hence, death must result." Buxton goes on to state that it is impossible to say whether the corpuscles, in some cases after the administration of an anæsthetic, have a lessened power of taking up oxygen; but that it seems probable that such is the case.

Hamilton Fish (*ANNALS OF SURGERY*, July, 1899) has contributed an extremely valuable article, which he designates, "The Importance of Blood Examinations in Reference to General Anæsthetization and Operative Procedures." He takes the affirmative on the question of whether or not ether reduces hæmoglobin and affects red corpuscles. He believes that anæsthesia may lessen tissue resistance, and thus lead to septic lesions; and he thinks that the condition of the blood is a fairly accurate gauge of the patient's general condition, and that the blood should always be examined before the administration of an anæsthetic. He says that those that labor under neurasthenia, anæmia, chlorosis, leukæmia, and the lymphatic temperament have blood in which marked changes can be demonstrated; and that all of these patients stand operations, and also anæsthesia, badly. Fish advocates the view that an anæsthetic extracts oxygen from oxyhæmoglobin, and combines with the latter; and he further asserts that in patients with less than 50 per cent. of hæmoglobin, oxygen is taken away from corpuscles which are so poor in that element that they cannot spare it. As a consequence, such corpuscles are unable to give up any oxygen to the tissues; and these patients, when under the influence of ether, will show evidences of collapse. Fish reminds us that respiration depends upon the nervous system and upon the amount of hæmoglobin in the blood, and that if hæmoglobin is reduced below a certain limit respiration ceases. He thinks that the minimum is 20 per cent., and refers to the observation of Mikulicz that

in three cases dying of collapse during operation 15 per cent. of hæmoglobin was found remaining in the blood. In Fish's opinion, the safest rule is not to give an anæsthetic if the hæmoglobin is under 50 per cent.; anything above 80 per cent. he considers normal. An amount of anæsthetic which is perfectly harmless when there is 80 per cent. of hæmoglobin may be extremely dangerous when there is but 50 per cent. Fish also points out the important fact that safe anæsthesia depends not alone upon a good percentage of hæmoglobin, but also upon the existence of a normal or increased number of polynuclear neutrophiles. He regards the leucocytosis of anæsthesia as phagocytic in character, and as a measure of individual resistance. He believes that the blood should be examined not only before but during anæsthesia; because the first evidence of approaching danger may be found in a blood change. He also points out the interesting fact that at an altitude of one mile normal hæmoglobin is reduced from 12 to 15 per cent. during the first hour of anæsthesia.

Dr. Joseph G. Bloodgood, of the Johns Hopkins Hospital (*"Progressive Medicine,"* Vol. iv, 1900), in reviewing Dr. Hamilton Fish's article, entirely agrees with that author's conclusions, and cites several cases occurring in the Johns Hopkins Hospital to confirm these views.

From the above quoted opinions it will be observed that wide divergences exist among the views of the different writers upon this subject,—between the views which J. Chalmers Da Costa put forth in 1895 and the results of the experiments upon rabbits made by Oliver; between the broad affirmation of the belief that ether lowers hæmoglobin and has a destructive influence upon corpuscles, in the article by Hamilton Fish, the absolute denial of this by Von Lerber, and the rather conservative opinion of Dudley Buxton. The controversialists are like the two knights of allegory who stood upon opposite sides of the shield, disputing as to the words graven upon it; each one saw his own side, and each was right and both were wrong. It becomes evident that some of the observations must be entirely erroneous; or else undiscovered factors and unrecognized elements exist in the problem, which make all previous observations never entirely correct and never

completely wrong. These discrepancies and disagreements may depend upon the personal equation; upon the employment of different methods to estimate the hæmoglobin; upon the different altitudes above the sea at which the experiments were made; upon the daily and nightly oscillations which are known to occur in the percentage of hæmoglobin and corpuscles; upon the uncertain results obtained by the hæmoglobinometer; upon the different methods taken to secure the blood, and the fact that it may have been taken from different portions of the body; upon the fact that the extremity from which the blood was taken may or may not have been elevated, and also that massage and manipulation may or may not have been employed; upon the fact that in some cases digestion may have been going on, while in others it may not have been; and particularly upon the fact that in some cases the blood may have been concentrated by purgation and diaphoresis, while in others it may not have been.

In Da Costa's former cases the patients were in many instances taken from the dispensary and etherized without previous preparation. In this new series of cases we determined that the patients should be those carefully prepared for operation,—a preparation which involves concentration of the blood by purgation, which concentration is usually added to by profuse sweating during the anæsthetic state. We further determined to have all the blood examinations made by a thoroughly competent third party, who would make them all in exactly the same manner, who would have no view of his own, and who would not be lured from the path of accurate observation by any theoretical Jack-a-lantern. We selected for this work Dr. A. G. Ellis, the Pathological Resident of the Jefferson College Hospital, who performed it with the utmost skill and care; and we wish here to extend to him our thanks. Further, we decided that the table, when completed, should be broken up into numerous sub-tables, according to the time before and after operation when the blood was examined; to the duration of the anæsthesia; to the amount of ether used; to the estimated quantity of blood lost, etc. It is our aim in these investigations to consider the sub-

ject, as far as possible, from a practical rather than from an experimental stand-point. We concluded to gather fifty cases, taken out of the general run of patients in a busy hospital,—the Jefferson Medical College Hospital. The cases were selected from the various wards,—surgical, gynæcological, etc. The blood examinations, which were made before and after the operations, consisted of the estimation of the number of erythrocytes, the hæmoglobin percentage, the color index, and the number of leucocytes. Differential counts of the leucocytes were not undertaken, for it was not our object to study the leucocytic changes in detail. The results of the blood examination before the operation were compared with those after the operation. It was practically impossible to always set a definite time before the operation, as the period in which the observation should be made, so we decided to make the examination in a number of cases within a reasonable period preceding operation; that is, within some hours of the time of going to the operating room. In other instances the blood examinations were made some time before going to the clinic room, on account of postponement of the operation. In some cases examination was deliberately made a considerable time before operation, in order to anticipate preparatory methods of treatment. Similar difficulties were encountered in arriving at the proper time for the blood examinations after the operation. The counts following the operation were made either immediately after or upon the day following. Examinations were not made during the anæsthetic state; for our particular aim was to determine the changes which follow etherization, rather than the changes that are evident during the anæsthetic period.

Blood Concentration.—The problem of blood concentration naturally presented itself, for the preparatory operative treatment includes measures which tend to increase the elimination of the watery principles of the body, while the intake of fluids is always reduced prior to and for a time after the operation. The general rules governing preparatory measures of treatment at the Jefferson Medical College Hospital consist in

- (a) A hot bath;
- (b) Active purgation;
- (c) Reduction of diet, and withholding of all food and liquid for some hours preceding the operation;
- (d) Occasionally the administration of heart stimulants.

Cause of Blood Concentration.—It is generally admitted that such conditions as increased blood pressure, diarrhœa, profuse sweating, frequent vomiting, and the withdrawal of a large quantity of serous fluid,—which is rapidly replaced by the transfusible elements of the blood,—and deprivation of fluids, all tend to produce blood inspissation. It is a well-known fact that the blood of individuals suffering from Asiatic cholera shows concentration to a high degree. The finding of 6,000,000 or more red blood-cells per cubic millimetre in this disease is not unusual. Cabot ("Clinical Examination of the Blood"), in referring to the work of Hay, "On the Action of Saline Cathartics," states that "Hay gives the following figures, showing the effect of sulphate of sodium in concentrating the blood: Subject, a healthy man of thirty-three years of age. 3.35 P.M., red corpuscles, 5,250,000; was given 85 cubic centimetres of a concentrated solution of sulphate of sodium in water. Thirty-five minutes later, the blood count showed red corpuscles, 6,540,000; sixty-five minutes later, it showed red corpuscles, 6,790,000; and four hours later, red corpuscles, 4,930,000. Evidently much fluid was drawn out of the blood-vessels; and then within four hours the tissues had supplied the loss, and the blood had returned to its normal density. Hay also showed that a dilute solution of the same drug had far less effect in concentrating the blood. Further, he demonstrated that if blood is already concentrated when the saline is given, no purgative effect follows."

Concentration is well shown after profuse sweating. Oliver (*Lancet*, June 27, 1896) reports temporary apoplexia produced by a Turkish bath. In this case the corpuscular percentage was 91 before the bath, while immediately after the bath it was 106, and two hours after the bath the percentage fell to almost 99. Thirty ounces of beer were ingested half an hour after the bath.

Oliver, in referring to the variations in the volume of the plasma, states that "when, for example, the output of water, whether by the kidneys, the skin, or the bowels, temporarily exceeds the income, the volume of the plasma is for a time reduced, and there is a proportionate rise in the corpuscles." He further states that "the concurrent variations in the percentage of the corpuscles and hæmoglobin, which have been so repeatedly pointed out, are indeed volumetric indications of the circulation of the water into or from the blood; into it from the digestive tract and the tissues, and from it by the kidneys, skin, and lungs, and probably into the muscles during exercise. The blood is continually tending to balance its income and output of water, and is thus always striving for a mean; but, notwithstanding this wonderful, persistent adjustment, variations in the proportion of water present in the plasma are, at the same time, shown by these observations to be constantly taking place within certain physiological limits." Blood inspissation is also produced by increased blood pressure; for example, small doses of suprarenal extract increase arterial tension, thereby favoring the elimination of water, and consequently inducing polycythæmia. It is worthy of mention that in the blood concentration occurring in the healthy individual, within the physiological limits, the rise in the corpuscular and hæmoglobin percentage is parallel; the blood decimal, therefore, does not change. The rapidity with which the blood loses some of its diffusible elements, therefore, must always be borne in mind; and the rapidity with which the blood again dilutes is a matter no less important. It is undoubtedly true that the loss of the watery elements of the plasma is only transitory; nevertheless, the rapidity with which the blood tends to reach the normal probably varies greatly in individual cases, and is modified by many factors. The following statement of Cabot ("Clinical Examination of the Blood"), in regard to the subject of blood concentration, is indeed worthy of careful consideration at all times, when dealing with blood examinations. "In the presence, therefore, of any such reason for

the concentration of the blood, we should always modify our ordinary methods of inference from the blood counts."

Blood Destruction (Hæmolysis) and Blood Formation (Hæmogenesis).—In health, the number of erythrocytes and the amount of hæmoglobin maintain a uniform standard; the formation of the new red blood-cells and the destruction of the colored elements progresses uniformly. The subject of the average life of the erythrocytes has received much discussion, but still remains an unsettled question. It has been suggested that the average duration of the life of the chromocyte appears to be about two weeks or less; therefore 357,152 red blood-cells per cubic millimetre are destroyed each day. In other words, the destruction is at the rate of 248 per minute in each cubic millimetre of blood. Hæmogenesis progresses accordingly.

Blood Regeneration.—In order to base our conclusions upon scientific principles, it is essential to consider the generally accepted views governing blood regeneration. These may be summarized as follows: Immediately following the loss of blood (for example, in a traumatic hæmorrhage), the erythrocytes and the hæmoglobin are reduced proportionately; in a short time the other tissues of the body compensate for the volume of fluid lost from the blood. Following this dilution, erythrocytic regeneration progresses rapidly, and the number of corpuscles lost is restored to the proper level in a short time; the hæmoglobin, however, is not replaced so quickly. Therefore, the newly formed corpuscles in the circulation are deficient in coloring matter, and the total hæmoglobin percentage is below the corpuscular percentage; consequently, there is a reduction in the average blood decimal. After the lapse of some time the hæmoglobin is restored, and the erythrocytic regenerative properties of the blood-making organs gradually become normal.

Blood Concentration and Anæmia.—Blood concentration may progress or be associated with anæmic states. In cases of this kind the total volume of the blood is reduced; the number of erythrocytes may appear to be normal or to exceed the normal; while the hæmoglobin will not present the same

increase, although the percentage may be increased; but the total amount is diminished, as is shown by the lowered color index. When the blood becomes diluted and inspissation disappears, the percentage of corpuscles and hæmoglobin is lowered; while the blood decimal remains unaltered unless improvement follows, which will be indicated by a rise in the corpuscular hæmoglobin value.

RECORDS.

In gathering our clinical data, we particularly emphasize the points bearing upon the conditions which produce blood inspissation, endeavoring to determine, therefore, in a general way the loss of the watery constituents of the body. The task of gathering the clinical notes was assigned to the Resident Physicians of the Jefferson College Hospital. The following chart was prepared so as to facilitate their work:

Number.....	Name.....	Age.....	Sex.....	Date.....
Nativity.....	Occupation.....	Ward.....	Doctor.....	
Diagnosis.....	Date of Admission.....			
Date of Discharge.....				
Revised Diagnosis.....	Result.....			
.....				
History				
Physical Examination.....				
Character and Amount of Urine in Twenty-four Hours before and after Anæsthesia				
Character and Amount of Vomit before and after Anæsthesia.....				
Character and Amount of Bowel Movement before and after Anæsthesia				
Amount of Sweating before and after Anæsthesia.....				
Remarks. (Was any large quantity of fluid lost before or after operation?)				
Date, Hour, and Character of Operation.....				
Blood Loss.....				
Duration of Anæsthesia.....				
Character and Amount of Anæsthetic.....				

Blood Examination.

Date and Hour before Operation.	Date and Hour after Operation.
Hæmoglobin	Hæmoglobin
Erythrocytes	Erythrocytes
Leucocytes	Leucocytes
Color Index.....	Color Index.....

Hæmatological Examination.—In procuring the blood for examination, the following rules were always observed: The

patients were in the recumbent posture. The blood was taken from the tip of the finger. In no case was the hand cedematous. The skin was cleaned with water or a little soap and water; next, with alcohol, and was then dried. The part was warmed by a gentle friction; care was taken not to excite hyperæmia by a vigorous rubbing. The puncture was effected with a clean needle having a cutting surface, and was made deep enough to insure a free flow of blood without squeezing the part near the wound. The first drop was always wiped away. The number of erythrocytes and leucocytes was estimated with the Thoma-Zeiss hæmocytometer. In determining the number of the red cells, a 2 per cent. salt solution was used as a diluent, in the proportion of one part of blood to 200 parts of the solution. A 1 per cent. acetic acid solution was used as the diluting fluid, in the proportion of 1 to 20, in estimating the number of leucocytes. In ascertaining the number of erythrocytes, the corpuscles over eighty squares were counted; while the corpuscles over 400 squares were enumerated in determining the number of leucocytes. The hæmoglobin estimations were made with Oliver's hæmoglobinometer, except in four cases in which the Fleischl instrument was employed.

Tabulation of Cases.—After the various facts had been collected, the fifty cases were arranged in a tabular form. The facts included in this table are the name, sex, nativity, and occupation of the patient; the ward, the diagnosis, the date of admission, the date of discharge, the result, the character of the operation, the date and hour of the operation, the estimated blood loss, the anæsthetic employed, the amount of the anæsthetic used, the duration of the period of anæsthesia, the date and hour of the blood examination before the operation (the examination includes the hæmoglobin percentage, the number of erythrocytes per cubic millimetre, the number of leucocytes per cubic millimetre, and the color index), the date and hour of the blood examination after the operation, which again includes the hæmoglobin percentage, the number of erythrocytes per cubic millimetre, the number of leucocytes per cubic millimetre, and the color index.

TABLE I.

Case No.	BEFORE ANÆSTHESIA.			AFTER ANÆSTHESIA.			DIFFERENCE.		
	Corpuscles.	Color Index.	Hæmo. per cent.	Corpuscles.	Color Index.	Hæmo. per cent.	Cor. Loss or Gain.	Hæmo. Loss or Gain.	Color Index Loss.
1.	3,245,000	.89	58	3,920,000	.76	60	675,000+	2+	.13
2.	4,170,000	.9	75	5,390,000	.742	80	1,220,000+	5+	.158
3.	3,795,000	.724	55	4,330,000	.577	50	535,000+	5-	.147
4.	4,050,000	.92	75	5,160,000	.82	85	1,110,000+	10+	.10
5.	5,340,000	.889	95	5,370,000	.884	95	30,000+	0+0-	.005
6.	5,130,000	.926	95	5,250,000	.9	95	120,000+	0+0-	.026
7.	4,575,000	.82	75	4,600,000	.76	70	25,000+	5-	.06
8.	4,680,000	.908	85	4,850,000	.824	80	170,000+	5-	.084
9.	4,750,000	.863	82	4,620,000	.811	75	130,000-	7-	.052
10.	4,520,000	.94	85	4,950,000	.808	80	430,000+	5-	.132
11.	4,500,000	.944	85	4,240,000	.943	80	260,000-	5-	.001
12.	4,375,000	.857	75	4,387,000	.683	60	12,500+	15-	.174
13.	3,820,000	.982	75	4,810,000	.779	75	990,000+	0+0-	.203
14.	5,660,000	.75	85	5,490,000	.728	80	170,000-	5-	.022
15.	5,210,000	.959	100	5,360,000	.886	92	150,000+	5-	.073
16.	3,680,000	.87	64	5,230,000	.592	62	1,550,000+	2-	.278
17.	4,160,000	.841	70	3,900,000	.77	60	260,000-	10-	.071
18.	4,940,000	.88	87	5,600,000	.848	95	660,000+	8+	.032
19.	5,140,000	.826	85	4,850,000	.824	80	290,000-	5-	.002
20.	4,710,000	.934	88	5,025,000	.708	95	1,215,000+	7+	.136
21.	5,560,000	.809	90	5,800,000	.801	93	240,000+	3+	.008
22.	5,190,000	.915	95	5,880,000	.85	100	690,000+	5+	.065
23.	4,920,000	.945	93	5,740,000	.827	95	820,000+	2+	.118
24.	3,970,000	1.000	80	3,890,000	.964	75	80,000-	5-	.036
25.	4,440,000	.822	73	5,650,000	.796	90	1,210,000+	17+	.026
26.	4,780,000	.868	83	4,870,000	.739	72	90,000+	11-	.129
27.	4,820,000	.964	83	5,137,000	.924	95	317,000+	12-	.040
28.	5,430,000	.874	95	6,130,000	.792	100	700,000+	5+	.082
29.	5,650,000	.911	103	6,070,000	.807	98	420,000+	5-	.104
30.	5,070,000	.936	95	6,375,000	.902	115	1,305,000+	20+	.034
31.	4,880,000	.922	90	5,360,000	.904	97	480,000+	7+	.018
32.	5,480,000	.865	95	6,620,000	.83	110	1,140,000+	15+	.035
33.	5,520,000	.995	110	6,120,000	.776	95	600,000+	15-	.219
34.	5,160,000	.92	95	6,000,000	.862	105	930,000+	10+	.058
35.	5,040,000	.992	100	5,720,000	.83	95	680,000+	5-	.162
36.	5,590,000	.983	110	6,225,000	.963	120	635,000+	10+	.020
37.	5,890,000	.933	110	6,710,000	.842	113	820,000+	3+	.091
38.	6,130,000	.938	115	5,380,000	.93	100	750,000-	15-	.008
39.	3,900,000	.641	50	4,060,000	.492	40	160,000+	10-	.149
40.	6,280,000	.954	120	6,070,000	.93	113	210,000-	7-	.024
41.	6,100,000	.983	120	6,170,000	.988	122	70,000+	2+	+
42.	4,920,000	.873	80	5,300,000	.66	70	380,000+	10-	.213
43.	5,550,000	1.030	115	6,030,000	.829	100	480,000+	15-	.201
44.	4,600,000	1.000	92	5,050,000	.891	90	450,000+	2-	.109
45.	5,350,000	.981	105	4,880,000	.922	90	470,000-	15-	.059
46.	4,880,000	1.020	100	6,040,000	.91	110	1,160,000+	10+	.11
47.	5,330,000	.863	92	5,750,000	.782	90	420,000+	2-	.081
48.	4,700,000	.957	90	5,120,000	.859	88	420,000+	2-	.098
49.	5,500,000	.936	103	5,700,000	.831	95	200,000+	8-	.105
50.	5,940,000	.942	112	6,080,000	.904	110	140,000+	2-	.038
Aver.	4,977,440	.903	89	5,126,800	.821	86+	149,360+	3-	.082

GENERAL SUMMARY OF THE BLOOD CHANGES.

Erythrocytes.—The number of chromocytes was increased in forty-one cases and decreased in nine. The average count before the operation was 4,977,440; the average count after the operation was 5,126,800; and the gain was 143,360 per cubic millimetre.

Hæmoglobin.—The average hæmoglobin percentage preceding the anæsthetic state was 89; the average hæmoglobin percentage following the anæsthetic state was 86, showing a loss of 3 per cent. The hæmoglobin revealed an apparent increase in nineteen cases, and a decrease in twenty-eight cases, and there was no loss or gain in three instances. The average gain in the nineteen cases was 8.05 per cent., while the average loss in the twenty-eight cases was 7.25 per cent.

Color Index.—The average individual corpuscular hæmoglobin value preceding the operation was .903, while that following was .821, showing an average loss of .082. In forty-nine out of the fifty cases, the blood decimal was reduced after the operation. In one instance only was the color index slightly increased after the anæsthetic state. This occurred in Case No. 41. The color index preceding the operation was .983, and that following the operation was .988; in this instance the blood decimal was practically unchanged.

Leucocytes.—The number of leucocytes varied greatly before and after the operation. The average count preceding the operation was 9898, and the average count following was 14,484, showing an average gain of 4586 per cubic millimetre. In forty-three instances the leucocytes were increased, while in nine instances the number was decreased after the operation.

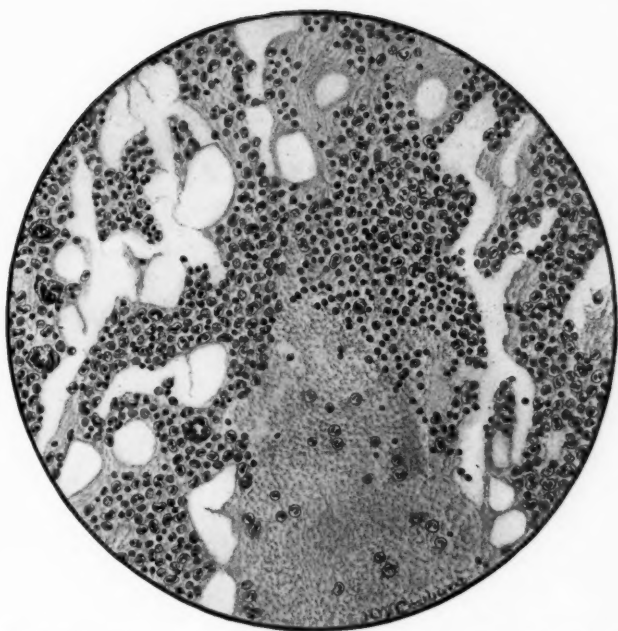


FIG. 1.—Section of normal bone marrow of femur (of rabbit).

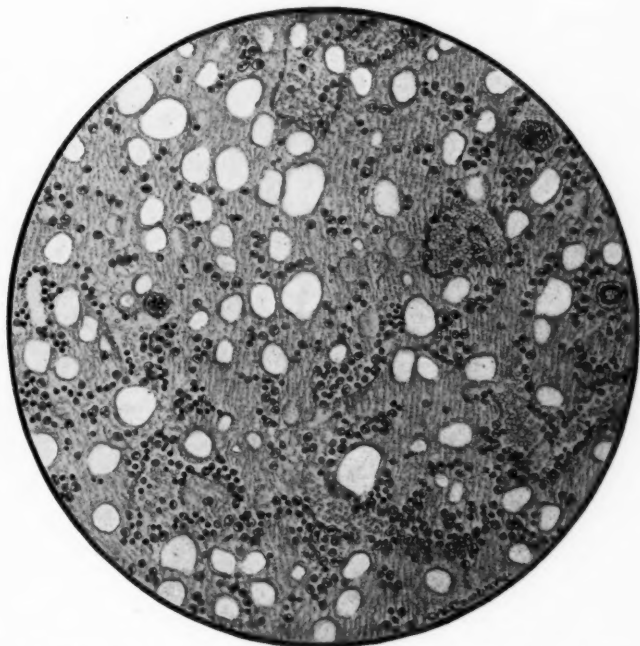


FIG. 2.—Section of bone marrow of femur (of rabbit) showing marked erythroblastic proliferation after death by etherization.



TABLE II.

Group A.

BLOOD EXAMINATIONS MADE A SHORT TIME BEFORE AND SOON AFTER ANÆSTHESIA.

Number.	Time between Blood-Count before Operation and Operation.	Time between Operation and Blood-Count after Operation.
6.	3 hours and 15 minutes.	6 hours.
7.	2 "	5 "
8.	3 "	5 "
9.	2 "	4 " and 45 minutes.
10.	2 " 15 "	4 " 30 "
13.	1 " 30 "	2 " "
18.	3 " "	5 " 30 "
29.	3 " 30 "	6 " "
36.	2 " "	4 " "
37.	1 " 30 "	5 " 30 "
40.	2 " 30 "	6 " "
41.	1 " 30 "	3 " "
44.	2 " 30 "	4 " "
45.	1 " 45 "	4 " 30 "
49.	3 " "	4 " 30 "
Average	2 " 21 "	4 " 41 "

Group B.

BLOOD EXAMINATIONS MADE A SHORT TIME BEFORE AND SOME TIME AFTER ANÆSTHESIA.

Number.	Time between Blood-Count before Operation and Operation.	Time between Operation and Blood-Count after Operation.
11.	2 hours and 45 minutes.	17 hours and 30 minutes.
12.	1 " "	21 " 45 "
14.	2 " "	22 " "
19.	1 " 30 "	21 " 45 "
22.	2 " 15 "	21 " "
23.	2 " 45 "	20 " 30 "
25.	5 " 30 "	22 " 30 "
26.	1 " 30 "	24 " "
27.	4 " "	21 " "
28.	3 " 30 "	17 " "
30.	4 " "	19 " "
32.	3 " 30 "	19 " 30 "
33.	2 " "	21 " 30 "
34.	1 " 30 "	22 " "
35.	3 " 30 "	19 " "
38.	3 " 15 "	21 " "
42.	3 " "	21 " "
43.	3 " 30 "	21 " 45 "
46.	" 45 "	23 " "
47.	3 " 45 "	20 " 30 "
48.	2 " "	22 " "
50.	2 " 15 "	22 " "
Average	2 " 51 "	20 " 59 "

*Group C.*BLOOD EXAMINATIONS MADE SOME TIME BEFORE AND SOON AFTER
ANÆSTHESIA.

Number.	Time between Blood-Count before Operation and Operation.	Time between Operation and Blood- Count after Operation.
5.	19 hours and 55 minutes.	4 hours and 5 minutes.
16.	23 "	1 "
21.	16 "	7 " 45 "
Average	19 " 38 "	4 " 16 "

*Group D.*BLOOD EXAMINATIONS MADE SOME TIME BEFORE AND SOME TIME AFTER
ANÆSTHESIA.

Number.	Time between Blood-Count before Operation and Operation.	Time between Operation and Blood- Count after Operation.
1.	23 hours and 10 minutes.	19 hours and 5 minutes.
2.	29 " 23 "	19 " 7 "
3.	25 " 10 "	20 " 50 "
4.	69 " 30 "	18 " "
15.	72 " "	19 " "
17.	23 " "	21 " 30 "
20.	24 " 30 "	22 " 30 "
24.	19 " "	19 " 30 "
31.	98 " 30 "	21 " "
39.	26 " "	20 " "
Average	41 " 1 "	20 " 3 "

CLASSIFICATION OF CASES.

So as to carefully compare the blood disturbances, it was found necessary to group the cases into four classes. This was done in order to find what bearing the preparatory and postoperative measures associated with the anæsthetic period have upon the blood disturbances. (See Table II.) In Group A those cases are included in which the first blood examination was made a short time before anæsthesia (average, 2 hours and 21 minutes), and soon after anæsthesia (average, 4 hours and 41 minutes). The cases included in Group B are those in which the blood examinations were made a short time before the operation (average, 2 hours and 51 minutes), and some time afterwards (average, 20 hours and 59 minutes). The cases in Group C include those in which the blood examination was made some time preceding the operation (average, 19 hours and 38 minutes) and soon after (average, 4 hours and 16 minutes). The cases included in

Group D are those in which the blood examination was made a considerable time before (average, 41 hours and 1 minute) and some time after the operation (average, 20 hours and 3 minutes).

In Group A, the result of the examination represents the changes that immediately follow the anæsthetic state; the first blood count, however, being made after the preparatory measures of treatment had been instituted, and the second count before the postoperative treatment had been fairly begun. In Group B, the results show, in a general way, the effects of the anæsthetic state and the postoperative treatment. The count preceding the operation was, however, made during or at the height of the preparatory treatment. In Group C the results represent the blood changes which occur during the preparatory treatment and during the anæsthetic state. In Group D the results include the effects produced by the preparatory treatment, the anæsthetic state, and the postoperative measures. Fifteen cases are included in Group A, 22 in Group B, 3 in Group C, and 10 in Group D.

TABLE III.

Group A.

Number.	First Count, made just before Anæsthesia.	Second Count, made just after Anæsthesia.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
6.	5,130,000	5,250,000	120,000		.026
7.	4,575,000	4,600,000	25,000		.06
8.	4,680,000	4,850,000	170,000		.084
9.	4,750,000	4,620,000		130,000	.052
10.	4,520,000	4,950,000	430,000		.132
13.	3,820,000	4,810,000	990,000		.203
18.	4,940,000	5,600,000	660,000		.032
29.	5,650,000	6,070,000	420,000		.104
36.	5,590,000	6,225,000	635,000		.02
37.	5,890,000	6,710,000	820,000		.091
40.	6,280,000	6,070,000		210,000	.024
41.	6,100,000	6,170,000	70,000		+slight.
44.	4,600,000	5,050,000	450,000		.09
45.	5,350,000	4,880,000		470,000	.059
49.	5,500,000	5,700,000	200,000		.105
Average			265,000		.077

Group B.

Num- ber.	First Count, made just before Anæsthesia.	Second Count, some time after Anæsthesia.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
11.	4,500,000	4,240,000		260,000	.001
12.	4,375,000	4,387,500	12,500		.174
14.	5,660,000	5,490,000		170,000	.022
19.	5,140,000	4,850,000		290,000	.002
22.	5,190,000	5,880,000	690,000		.065
23.	4,920,000	5,740,000	820,000		.118
25.	4,440,000	5,650,000	1,210,000		.026
26.	4,780,000	4,870,000	90,000		.129
27.	4,820,000	5,137,000	317,000		.040
28.	5,430,000	6,130,000	700,000		.082
30.	5,070,000	6,375,000	1,305,000		.034
32.	5,480,000	6,620,000	1,140,000		.035
33.	5,520,000	6,120,000	600,000		.219
34.	5,160,000	6,090,000	930,000		.058
35.	5,040,000	5,720,000	680,000		.162
38.	6,130,000	5,380,000		750,000	.008
42.	4,920,000	5,300,000	380,000		.213
43.	5,550,000	6,030,000	480,000		.201
46.	4,880,000	6,040,000	1,160,000		.11
47.	5,330,000	5,750,000	420,000		.081
48.	4,700,000	5,120,000	420,000		.098
50.	5,940,000	6,080,000	140,000		.038
Average			460,204		.084

Group C.

Num- ber.	First Count, some time before Anæsthesia.	Second Count, some time after Anæsthesia.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
5.	5,340,000	5,370,000	30,000		.005
16.	3,680,000	5,230,000	1,550,000		.278
21.	5,560,000	5,800,000	240,000		.008
Average			740,000		.097

Group D.

Num- ber.	First Count, some time before Anæsthesia.	Second Count, made just after Anæsthesia.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
1.	3,245,000	3,920,000	675,000		.13
2.	4,170,000	5,390,000	1,220,000		.158
3.	3,795,000	4,330,000	535,000		.147
4.	4,050,000	5,160,000	1,110,000		.10
15.	5,210,000	5,360,000	150,000		.073
17.	4,160,000	3,900,000		260,000	.071
20.	4,710,000	5,925,000	1,215,000		.136
24.	3,970,000	3,890,000		80,000	.036
31.	4,880,000	5,360,000	480,000		.018
39.	3,900,000	4,060,000	160,000		.149
Average			520,000		.102

Number of Erythrocytes.—The average gain per cubic millimetre in Group A was 265,000; twelve cases in this class showed a gain in the number of colored corpuscles, while there was a loss in three cases. (See Table III.)

The average gain per cubic millimetre in Group B was 460,204 corpuscles; and there was an increase in the number of erythrocytes in eighteen cases and a decrease in four cases.

The average gain per cubic millimetre in Group C was 740,000 corpuscles; every case in this group showed an increase in the number of red cells.

In Group D the average gain was 520,000 corpuscles per cubic millimetre; eight cases showed an increase in the number of chromocytes, and two cases showed a decrease.

In Series A, Cases 9, 40, and 45, and in Series B, Cases 11, 14, 19, and 38, indicate that the preparatory treatment produced marked concentration of the blood, which was probably at its height at the time of the first examination or a short while afterwards, the blood having become somewhat diluted before the second count was made. In the remaining cases of Series A and B, the marked increase in the number of erythrocytes must be attributed to the blood inspissation. In Series C, a gain in the number of chromocytes only was noted. This was probably due to the fact that two of the factors which produce blood inspissation, namely, preparatory treatment and sweating during the anæsthetic period, were taken into consideration; the first count was made before the concentration. In Series D, Cases 17 and 24 show that the equilibrium existing between the plasma and the corpuscles was being restored, for the reason that the first blood counts were made prior to the preparatory treatment; the figures may even represent an absolute loss of chromocyte. In Series A, the average gain of 265,000 corpuscles appears to represent the degree of concentration over the inspissation induced by the preparatory measures produced during the anæsthetic period. In Series B, the average gain of 460,204 cells per cubic millimetre represents the degree of concentration produced during the anæsthesia and the postanæsthetic period.

In Series C the average gain of 740,000 cells per cubic millimetre represents the concentration produced by the preparatory measures of treatment and the anæsthetic period. It will be noticed that the average gain in Series C is greater than in any of the other groups. The explanation for this is probably that the period preceding the operation and the anæsthetic stage produced the highest degree of inspissation. In Series D, the average gain was 520,000 per cubic millimetre. This increase in the number of corpuscles represents the degree of inspissation produced by the three periods. It is apparent, however, that this gain is not so striking as the gain in Series C, probably for the reason that blood dilution has been active in some of the cases before the last examination.

Hæmoglobin.—The hæmoglobin gain and loss, when analyzed in regard to the four periods, A, B, C, and D, show varying results. In some instances the hæmoglobin is decreased; this necessarily represents an absolute decrease. When the total blood volume is fluctuating, the gain and loss of hæmoglobin are best determined by studying the individual corpuscular value in hæmoglobin.

Color Index.—The loss in the color index in Series A, namely, in that series in which the blood was examined just before and just after the anæsthetic stage, the color value was reduced in all but one instance. The average loss of color index in this series was .077. This seems to demonstrate clearly that there was marked blood destruction and increased blood production during the period of anæsthesia, as indicated by the loss in the average, the newly formed erythrocytes being deficient in coloring matter. Although the blood was concentrated, the individual hæmoglobin value fell.

In every instance in Series B the color index was reduced. The average loss of color value was .084. The average loss in Series B was more marked than the average loss in Series A. The reason for this is probably that rapid hæmogenesis of cells deficient in hæmoglobin progressed over a longer period, as the second blood count was made some time

after the termination of the anæsthetic state. Therefore, the average color-value reduction was more pronounced.

In Series C, the average loss of color index was .097.

In Series D, the loss in the blood decimal was most pronounced; the average fall was .102. The explanation of this marked decrease is the same as that given for the change in Series B, namely, that erythrocytic regeneration was further advanced.

The constant loss in the color index is the most convincing evidence of rapid blood destruction. This loss in the color value occurred in Groups A, B, C, and D. In only one instance, in Group A, was there a slight gain; in every other instance there was a loss in the corpuscular hæmoglobin value. If the blood disturbances were due simply to concentration, the rise and fall in the percentage of corpuscles and the percentage of hæmoglobin would have been parallel, and the color index would not have been changed. The reduction in the color value of the corpuscles suggests rapid hæmocytolysis and increased hæmogenesis.

TABLE IV.

Group A.

BLOOD EXAMINATIONS MADE A SHORT TIME BEFORE AND SOON AFTER ANÆSTHESIA.

Number.	Duration of Operation.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
37.	90 minutes.	820,000		.091
41.	75 "	70,000		+ slight.
13.	65 "	990,000		.203
6.	60 "	120,000		.026
9.	60 "		130,000	.052
36.	38 "	635,000		.02
29.	37 "	420,000		.104
40.	35 "		210,000	.024
18.	30 "	660,000		.032
45.	30 "		470,000	.059
44.	25 "	450,000		.09
49.	25 "	200,000		.105
8.	24 "	170,000		.084
10.	23 "	430,000		.132
7.	12 "	25,000		.05

*Group B.*BLOOD EXAMINATIONS MADE A SHORT TIME BEFORE AND SOME TIME AFTER
ANÆSTHESIA.

Number.	Duration of Operation.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
19.	90 minutes.		290,000	.002
33.	83 "	600,000		.219
50.	73 "	140,000		.038
30.	67 "	1,305,000		.034
26.	65 "	90,000		.129
28.	65 "	700,000		.082
32.	60 "	1,140,000		.035
42.	55 "	380,000		.213
25.	48 "	1,210,000		.026
34.	45 "	930,000		.058
35.	45 "	680,000		.162
46.	45 "	1,160,000		.11
11.	40 "		260,000	.001
43.	40 "	480,000		.201
22.	38 "	690,000		.065
38.	30 "		750,000	.008
23.	28 "	820,000		.118
12.	27 "	12,500		.174
27.	25 "	317,000		.040
47.	25 "	420,000		.081
48.	20 "	240,000		.098
14.	18 "		170,000	.022

*Group C.*BLOOD EXAMINATIONS MADE SOME TIME BEFORE AND SOON AFTER
ANÆSTHESIA.

Number.	Duration of Operation.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
21.	105 minutes.	240,000		.008
5.	55 "	30,000		.005
16.	19 "	1,550,000		.278

*Group D.*BLOOD EXAMINATIONS MADE SOME TIME BEFORE AND SOME TIME AFTER
ANÆSTHESIA.

Number.	Duration of Operation.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
3.	120 minutes.	535,000		.147
4.	120 "	1,110,000		.10
20.	95 "	1,215,000		.136
15.	90 "	150,000		.073
39.	90 "	160,000		.149
17.	60 "		260,000	.071
2.	47 "	1,220,000		.158
1.	35 "	675,000		.13
24.	35 "		80,000	.036
31.	25 "	480,000		.018

TABLE V.

*Group A.*BLOOD EXAMINATIONS MADE A SHORT TIME BEFORE AND SOON AFTER
ANÆSTHESIA.

Number.	Amount of Ether used.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
18.	270 cubic centimetres.	660,000		.032
29.	270 " "	420,000		.104
41.	255 " "	70,000		+slight.
9.	6.0 " " chlorof.			
	180 " "		130,000	.052
37.	240 " "	820,000		.091
6.	210 " "	120,000		.026
36.	165 " "	635,000		.02
13.	7.8 " " chlorof.			
	144 " "	990,000		.203
10.	150 " "	430,000		.132
40.	150 " "		210,000	.024
45.	150 " "		470,000	.059
8.	135 " "	170,000		.084
49.	120 " "	200,000		.105
44.	75 " "	450,000		.09
7.	7.2 " " chlorof.			
	45 " "	25,000		.06

*Group B.*BLOOD EXAMINATIONS MADE A SHORT TIME BEFORE AND SOME TIME AFTER
ANÆSTHESIA.

Number.	Amount of Ether used.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
33.	405 cubic centimetres.	600,000		.219
32.	360 " "	1,140,000		.035
11.	240 " "		260,000	.001
26.	240 " "	90,000		.129
43.	240 " "	480,000		.201
50.	240 " "	140,000		.038
19.	225 " "		290,000	.002
22.	195 " "	690,000		.065
42.	195 " "	380,000		.213
25.	180 " "	1,210,000		.026
28.	180 " "	700,000		.082
34.	154 " "	930,000		.058
30.	143 " "	1,305,000		.034
12.	7.2 " " chlorof.			
	128 " "	12,500		.174
23.	135 " "	820,000		.118
38.	120 " "		750,000	.008
27.	105 " "	317,000		.040
46.	90 " "	1,160,000		.11
47.	90 " "	420,000		.081
48.	75 " "	240,000		.098
14.	6.0 " " chlorof.			
	45 " "		170,000	.022
35.	30 " "	680,000		.162

*Group C.*BLOOD EXAMINATIONS MADE SOME TIME BEFORE AND SOON AFTER
ANÆSTHESIA.

Number.	Amount of Ether used.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
21.	330 cubic centimetres.	240,000		.008
5.	188 " "	30,000		.005
16.	103 " "	1,550,000		.278

*Group D.*BLOOD EXAMINATIONS MADE SOME TIME BEFORE AND SOME TIME AFTER
ANÆSTHESIA.

Number.	Amount of Ether used.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
3.	720 cubic centimetres.	535,000		.147
39.	330 " "	160,000		.149
1.	195 " "	675,000		.13
20.	180 " "	1,215,000		.136
2.	165 " "	1,220,000		.158
4.	165 " "	1,110,000		.10
31.	150 " "	480,000		.018
24.	120 " "		80,000	.036
17.	105 " "		260,000	.071
15.	75 " "	150,000		.073

The Duration of Operation and the Quantity of Ether employed.—The results do not seem to show any direct relationship between the blood disturbance and the duration of the operation. A similar statement may be made in regard to the quantity of ether. Of course, it is obvious that a prolonged operation upon a sound and vigorous patient will be tolerated better than even a brief operation upon one who is weak and exhausted; and also that some individuals will have much less blood destruction from the exhibition of a large quantity of ether than others will from inhaling a small quantity. On account of the many modifying factors, it is very difficult to determine the exact influence which the quantity of ether and the duration of the operation have upon the blood changes.

TABLE VI.

*Group A.*BLOOD EXAMINATIONS MADE A SHORT TIME BEFORE AND SOON AFTER
ANÆSTHESIA.

Number.	Blood Loss.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
6.	150 cubic centimetres.	120,000		.026
41.	120 " "	70,000		+slight.
9.	90 " "		130,000	.052
18.	90 " "	660,000		.032
49.	90 " "	200,000		.105
7.	30 " "	25,000		.06
8.	15 " "	170,000		.084
37.	15 " "	820,000		.091
13.	Small amount.	990,000		.203
10.	Minimum.	430,000		.132
29.	Bloodless.	420,000		.104
36.	"	635,000		.02
40.	"		210,000	.024
44.	"	450,000		.09
45.	"		470,000	.059

*Group B.*BLOOD EXAMINATIONS MADE A SHORT TIME BEFORE AND SOME TIME AFTER
ANÆSTHESIA.

Number.	Blood Loss.	Corpuscular Gain	Corpuscular Loss.	Loss of Color Index.
11.	120 cubic centimetres.		260,000	.001
19.	120 " "		290,000	.002
48.	120 " "	240,000		.098
26.	90 " "	90,000		.129
22.	60 " "	600,000		.065
35.	60 " "	680,000		.162
42.	60 " "	380,000		.213
47.	60 " "	420,000		.081
23.	30 " "	820,000		.118
25.	30 " "	1,210,000		.026
28.	30 " "	700,000		.082
38.	30 " "		750,000	.008
46.	30 " "	1,160,000		.11
50.	30 " "	140,000		.038
43.	15 " "	480,000		.201
32.	15 " "	1,140,000		.035
12.	Small.	12,500		.174
33.	"	600,000		.219
34.	Little.	930,000		.058
30.	Very slight.	1,305,000		.034
14.	Bloodless.		170,000	.022
27.	"	317,000		.040

*Group C.*BLOOD EXAMINATIONS MADE SOME TIME BEFORE AND SOON AFTER
ANÆSTHESIA.

Number.	Blood Loss.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
21.	240 cubic centimetres.	240,000		.008
5.	50 " "	30,000		.005
16.	15 " "	1,550,000		.278

*Group D.*BLOOD EXAMINATIONS MADE SOME TIME BEFORE AND SOME TIME AFTER
ANÆSTHESIA.

Number.	Blood Loss.	Corpuscular Gain.	Corpuscular Loss.	Loss of Color Index.
3.	473 cubic centimetres.	535,000		.147
4.	300 " "	1,110,000		.10
20.	240 " "	1,215,000		.136
2.	90 " "	1,220,000		.158
24.	60 " "		80,000	.036
15.	30 " "	150,000		.073
39.	30 " "	160,000		.149
31.	15 " "	480,000		.018
1.	Slight.	675,000		.13
17.	Very little.		260,000	.071

Blood Loss.—The blood loss was very slight in nearly all of the cases, and in some there was practically no loss at all (eye operations). It appears that the amount of blood lost did not affect the blood changes to a perceptible degree. In Cases 7, 9, and 13 in Group A, and Cases 12 and 14 in Group B, chloroform was used in conjunction with the ether. The amount of chloroform employed was very small.

Animal Experiments.—The constant fall in the color index after anæsthesia suggested the idea of experimental study in this line. It is our intention to continue this work from an experimental stand-point. We feel that the single experiment which has been performed is worthy of mention, although we do not attempt to draw any positive conclusions from a solitary observation. Two rabbits were obtained, almost identical in point of age, size, and appearance. One animal was etherized for two hours and twenty minutes, 150 cubic centimetres of ether being employed during the anæsthetic period.

A blood examination ten minutes prior to the beginning of the etherization showed 6,140,000 erythrocytes per cubic millimetre, 79 per cent. of hæmoglobin, and a color index of .693. The second blood count was made thirty-nine minutes after the beginning of the inhalation of the ether. This examination showed 6,260,000 erythrocytes, 69 per cent. of hæmoglobin, and a color index of .592. The third examination was made one hour and fifty minutes after the beginning of

the etherization; this count showed 7,000,000 erythrocytes, 69 per cent. of hæmoglobin, and a color index of .485. The animal was then killed with ether.

A Summary of the Post-Mortem Examination.—The serous cavities did not contain free fluid. The bladder contained a considerable quantity of urine, and the lower portion of the intestinal canal contained much thin fæcal matter. The spleen was small. The bone marrow of the right femur was bright red. Sections of the femur marrow were fixed in Gulland's formalin solution (formalin, 10 per cent., in absolute alcohol). They were dehydrated in alcohol and infiltrated in paraffin. The cut sections were stained with Ehrlich's triple stain—diluted with four times its volumes of water—for five minutes; washed in water; then treated for a few seconds with methylic alcohol; dehydrated in alcohol; cleared in xylol; and mounted in Canada balsam.

The other animal was killed by fracturing the spine. Upon post-mortem examination all of the serous cavities contained a small amount of fluid. The bone marrow of the right femur was not so red as was the marrow of the etherized animal, and was somewhat firmer. Pieces of this marrow were treated in a manner similar to the marrow of the etherized animal. Upon microscopic examination, by contrasting the marrow of the etherized animal and that of the non-etherized, it appears that in the former instance there is a marked cell proliferation, the cells being very numerous, and encroaching upon the normal fat spaces of the marrow. The cell proliferation in the marrow of the etherized rabbit involves particularly the erythroblastic elements; these cells are very numerous.

As previously stated, we hesitated to draw any conclusion from this single experiment; but, nevertheless, the very marked changes that were found are suggestive of the erythroblastic proliferation as a result of the ether. In the light of this experiment, it might be well to inquire whether the pains in the limbs and back, so common after anæsthetization, are not due, at least in part, to changes in the marrow. We must not omit to mention that the blood for examination was taken

from the ear; and that during the entire anæsthetic state only a trivial amount of blood was lost.

CONCLUSIONS.

(1) The number of red corpuscles is influenced by many factors associated with and accompanying the anæsthetic state. The character of this change is, as a rule, a polycythæmia; rarely, an oligocythæmia. These factors associated with and accompanying the anæsthetic state may be grouped into three classes. In each class when analyzed separately is found a cause capable of producing an increase in the number of colored corpuscles.

(2) The nature of this polycythæmia seems best explained by a lessening of the watery elements of the plasma, thereby reducing the total volume of the liquor sanguinis, and consequently causing concentration of the blood. It seems reasonable to infer that the polycythæmia is not influenced by excessive proliferative changes, which probably occur in the hæmatopoietic tissues. The increased blood production is an effort of nature to rapidly restore the destroyed cells.

(3) The three important factors incident to the polycythæmia are: (a) The period of preparatory operative treatment; (b) the anæsthetic state; and (c) the postoperative stage.

(4) The blood inspissation is, as a rule, most pronounced immediately after the termination of the anæsthetic stage. (See Group C.) In some instances the anhydræmia may be increased by each succeeding factor, or one of these factors may exceed the other; for example, the preparatory measures may bring about such a high grade of concentration that during the anæsthesia the polycythæmia may be stationary, or in a few hours may lessen somewhat. This variation existing between the plasma and the corpuscles, although temporary (for the economy adjusts the balance of the output and the intake of the watery principles of the blood with wonderful rapidity), should be regarded as too pronounced to be within the physiological limits. The relative increase in the number

of erythrocytes is generally still present some time after the operation. (See Group D.) But not infrequently the adjustment of the watery and solid elements manifests itself before this time, and an oligocythæmia may be present.

(5) The hæmoglobin is always reduced absolutely; in some instances there is an apparent increase, but this rise in the percentage of hæmoglobin is never parallel with the rise in the number of red blood-cells. The individual corpuscular hæmoglobin value is therefore reduced. This reduction in the color value of the chromocytes is most striking when the color index, ascertained some time before the operation, is compared with the blood decimal, determined some time after the operation. We must conclude that etherization produces increased hæmolysis; and in nature's effort to rapidly replace the destroyed corpuscles the regenerated cells are imperfectly supplied with hæmoglobin.

(6) The duration of the anæsthetic state and the amount of ether may influence the blood changes; but the extent of the disturbances could not be determined on account of the many modifying factors.

(7) The amount of blood loss, as encountered in this series of cases, does not seem to affect the blood.

(8) Whenever possible, one or more blood examinations should be made before giving a general anæsthetic; and the examinations should be made before preparatory treatment has been instituted. On account of the hæmolysis, which is shown by the fall in corpuscular hæmoglobin after operation, a very low percentage of hæmoglobin must be regarded as a contraindication to the administration of a general anæsthetic. The amount which should be regarded as a positive contraindication is uncertain. We think, with Hamilton Fish, that below 50 per cent. is a dangerous level. In malignant disease, and in cases where surgery might prolong life briefly but cannot cure, operation should not be performed under a general anæsthetic if hæmoglobin is below 50 per cent. We have operated in two cases in which the hæmoglobin was 40 per cent.; in each instance a vital emergency existed, and in

• each case death upon the table was narrowly averted. Mikulicz sets 30 per cent. as the lowest level at which operation is to be attempted. We must not give a general anæsthetic, except under the stress of absolute necessity, if the hæmoglobin is below 40 per cent. It is true that cases are occasionally anæsthetized with success when there is less than 40 per cent.; we know of one case with 30 per cent., and another with 24 per cent.; but a few exceptions do not disprove the rule. If there is a low percentage of hæmoglobin local anæsthesia should be employed whenever it is possible.

Whenever the percentage of hæmoglobin is low, if an operation is determined upon, the ordinary preparatory measures should be modified in every way, in order to avoid creating an undue drain upon the blood. If a general anæsthetic is given, its administration should be intrusted to an experienced man; as little as possible should be given; in many instances oxygen should be combined with it; the operation should be performed rapidly; proper measures should be taken to bring about reaction after its completion, and oxygen should be inhaled to remove the ether quickly from the lungs and blood.

STUDIES OF THE BLOOD IN ITS RELATION TO SURGICAL DIAGNOSIS.¹

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AMONG the problems which we undertook to investigate during the preparation of this paper, sufficient material for valid inferences has been secured only in four, viz.:

- (1) The effects of ether upon the leucocyte count.
- (2) The effects of operation upon the leucocyte count.
- (3) The effects of fractures upon the leucocyte count.
- (4) The regeneration of the blood after operations for malignant disease.

We shall also present, however, some observations which seem to us of interest on the variations of the white count in typhoid fever, and after muscular exertion.

I. *Leucocytosis after Ether*.—The importance of determining whether leucocytosis is increased by ether narcosis is obvious in the postoperative treatment of surgical cases. During this period the temperature chart and the leucocyte count are sometimes consulted for information regarding the progress of the healing process, and the possibility of septicæmia or of deep-seated pockets of pus. It is obvious that if we are to draw any conclusions from the leucocyte count, we must know, first, whether ether *per se* has any tendency to produce leucocytosis, and, secondly, how much, if at all, the leucocytes are affected by the operation itself aside from its later results. To determine these facts, we have had the leucocytes counted

¹ Read before the American Surgical Association, May, 1901.

(a) Before the ether was administered.

(b) After full anæsthesia and before the beginning of the operation.

(c) After operation.

In this way we have investigated fifty cases. In a general way our results tend to show that there is little, if any, leucocytosis during the period just after full etherization and just before the beginning of the operation, while after the operation there is not infrequently a moderate increase of the white cells. Out of the total of fifty cases, only thirteen showed an increase of more than 2000 leucocytes after full anæsthesia, while in seven there was an actual diminution in the leucocyte count. The only cases in which there was a considerable increase after etherization are the following:

No. 1.—Operation, Hernia. Before ether, 9,400. After ether, 12,400.

No. 2.—Operation, Hernia. Before ether, 8,200. After ether, 13,600.

No. 3.—Operation, Hernia. Before ether, 6,800. After ether, 9,400.

No. 4.—Operation, Stone in the bladder. Before ether, 15,800. After ether, 19,920.

No. 5.—Operation, Cancer of the cervix. Before ether, 12,400. After ether, 17,000.

No. 6.—Operation, Ovariectomy. Before ether, 13,800. After ether, 21,000.

No. 7.—Operation, Vaginal section. Before ether, 14,600. After ether, 25,000.

These results are in sharp contrast with those of Chadbourne (*Philadelphia Medical Journal*, February 18, 1899), who studied twenty-one cases, and found an increase in *every* case, the average being 37 per cent. He noted, however, that the leucocytosis was most marked during the *first part of etherization*, and that the increase was exceedingly rapid, some cases showing a change of 70 per cent. within a few minutes. Very possibly the subsequent fall towards the completion of the anæsthesia may have been equally rapid. The differential counts in Chadbourne's cases showed that all varieties of leucocytes were increased, the lymphocytes somewhat more than the others. Chadbourne considers the leucocytosis to be due to the irritation produced by the ether vapor upon the respira-

tory tract. Exhibited in tabular form, our results are as follows:

TABLE I.

TABLE OF CASES OF LEUCOCYTE COUNTS BEFORE AND AFTER ANÆSTHESIA (ETHER) AND AFTER OPERATION.

CASE 1.—Operation, Litholapaxy. Count before ether, 15,800. Count after ether but before operation, 19,920. Counts after operation, 19,300 same day; 15,400 next morning.

CASE 2.—Operation (?). Count before ether, 6,000. Count after ether but before operation, 8,600. Counts after operation, 16,600 same day; 11,120 next morning.

CASE 3.—Operation, Senile gangrene. Count before ether, 17,200. Count after ether but before operation, 13,600. Counts after operation, 19,000 same day; 16,100 next morning.

CASE 4.—Operation, Cancer of cervix. Count before ether, 12,400. Count after ether but before operation, 17,060. Counts after operation, 20,700 same day; 10,400 next morning.

CASE 5.—Operation, Appendix. Count before ether, 18,100. Count after ether but before operation, 17,520. Counts after operation, 21,600 same day; 12,600 next morning.

CASE 6.—Operation, Stone in kidney. Count before ether, 7,900. Count after ether but before operation, 7,200. Counts after operation, 27,300 same day; 13,700 (T. 101+) next morning.

CASE 7.—Operation, Excision of elbow. Count before ether, 8,060. Count after ether but before operation, 9,100. Count after operation, 8,100 same day.

CASE 8.—Operation, Ether examination. Count before ether, 14,400. Count after ether but before operation, 10,200. Count after operation, 10,600 same day.

CASE 9.—Operation, Hernia. Count before ether, 3,660. Count after ether but before operation, 5,600. Count after operation, 10,900 same day.

CASE 10.—Operation, Exploratory laparotomy. Count before ether, 17,000. Count after ether but before operation, 17,400. Count after operation, 14,400 same day.

CASE 11.—Operation, Stricture of urethra. Count before ether, 6,000. Count after ether but before operation, 6,400.

CASE 12.—Operation, Hernia. Count before ether, 5,200. Count after ether but before operation, 5,400. Count after operation, 7,200.

CASE 13.—Operation, Gr. $\frac{1}{6}$ strychnine given, gastro-enterostomy (cancer). Count before ether, 7,800. Count after ether but before operation, 7,600. Count after operation, 9,400.

CASE 14.—Operation, Cholecystotomy. Count before ether, 8,000. Count after ether but before operation, 9,200. Count after operation, 8,600.

CASE 15.—Operation, Gastrostomy. Count before ether, 6,400. Count after ether but before operation, 8,000. Count after operation, 8,400.

CASE 16.—Operation, Stricture of urethra. Count before ether, By

hospital officer, 10,000. *Count after ether but before operation*, 16,400. *Count after operation*, 16,000.

CASE 17.—Operation, Appendicitis. *Count before ether*, 8,600. *Count after ether but before operation*, 10,800. *Count after operation*, 10,200.

CASE 18.—Operation, Hernia (two and one-half hours). *Count before ether*, 9,000. *Count after ether but before operation*, 12,800. *Count after operation*, 13,400.

CASE 19.—Operation, Inguinal hernia. *Count before ether*, 6,000. *Count after ether but before operation*, 7,200. *Count after operation*, 8,400.

CASE 20.—Operation, Appendicitis. *Count before ether*, 16,000. *Count after ether but before operation*, 15,800. *Count after operation*, 17,200.

CASE 21.—Operation, Inguinal hernia. *Count before ether*, 8,200. *Count after ether but before operation*, 13,600. *Count after operation*, 14,800.

CASE 22.—Operation, Abscess of rectum. *Count before ether*, 10,000. *Count after ether but before operation*, 11,000. *Count after operation*, 11,000.

CASE 23.—Operation, Litholapaxy. *Count before operation*, 7,600. *Count after ether but before operation*, 8,800.

CASE 24.—Operation, Chronic mastitis. *Count before ether*, 14,800. *Count after ether but before operation*, 16,000. *Count after operation*, 16,600.

CASE 25.—Operation, Tumor of neck. *Count before ether*, 3,800. *Count after ether but before operation*, 4,600. *Count after operation*, 4,400.

CASE 26.—Operation, Hernia. *Count before ether*, 9,400. *Count after ether but before operation*, 12,400. *Count after operation*, 11,800.

CASE 27.—Operation, Empyema. *Count before ether*, 2,800. *Count after operation*, 23,000.

CASE 28.—Operation, Nephrectomy. *Count before ether*, 15,400. *Count after ether but before operation*, 15,800. *Count after operation*, 21,200.

CASE 29.—Operation, Enchondromata. *Count before ether*, 10,600. *Count after ether but before operation*, 11,000. *Count after operation*, 14,000.

CASE 30.—Operation, Hernia. *Count before ether*, 6,800. *Count after ether but before operation*, 9,400.

CASE 31.—Operation, Amputation of leg. *Count before ether*, 10,000. *Count after ether but before operation*, 12,800. *Count after operation*, 8,600.

CASE 32.—Operation, Suprapubic cystotomy. *Count before ether*, 20,400. *Count after ether but before operation*, 22,200. *Count after operation*, 22,800.

CASE 33.—Operation, Necrosis of tibia. *Count before ether*, 8,800. *Count after ether but before operation*, 11,200. *Count after operation*, 11,800.

CASE 34.—Operation, Salpingitis. *Count before ether*, 9,200. *Count after ether but before operation*, 9,800. *Count after operation*, 13,000.

CASE 35.—Operation, Laparotomy and vaginal section. *Count before ether, 7,900. Count after ether but before operation, 11,800. Count after operation, 9,400.*

CASE 36.—Operation, Vaginal section. *Count before ether, 18,600. Count after ether but before operation, 22,200. Count after operation, 20,000.*

CASE 37.—Operation, Vaginal section. *Count before ether, 14,600. Count after ether but before operation, 25,000. Count after operation, 21,600.*

CASE 38.—Operation, Vaginal section. *Count before ether, 8,000. Count after ether but before operation, 11,200. Count after operation, 8,600.*

CASE 39.—Operation, Laparotomy, double pus-tubes. *Count before ether, 13,000. Count after ether but before operation, 15,000. Count after operation, 18,000.*

CASE 40.—Operation, Hysterectomy (vaginal), considerable bleeding. Cancer of cervix. *Count before ether, 8,900. Count after ether but before operation, 10,000. Count after operation, 19,800.*

CASE 41.—Operation, Ovariectomy and ventral fixation. *Count before ether, 13,800. Count after ether but before operation, 21,000. Counts after operation, 21,400 same day; 12,000 next day.*

CASE 42.—Healthy medical student. *Count before ether, 10,200. Count after ether but before operation, 11,000. Count after ether, 9,400.*

CASE 43.—Operation, Ischio-rectal abscess. *Count before ether, 8,200. Count after operation, 10,000.*

CASE 44.—Operation, Dilating and curetting; hæmorrhoids. *Count before ether, 12,500. Count after operation, 22,000.*

CASE 45.—Operation, Abscess on hand, opened. *Count before ether, 14,000. Count after operation, 20,200.*

CASE 46.—Operation, Suspension of uterus. *Count before ether, 8,800. Count after operation, 24,000.*

CASE 47.—Operation, Cervix and sphincter ani. *Count before ether, 8,500. Count after ether but before operation, 9,200. Count after operation, 20,800.*

CASE 48.—Operation, Vagina and hæmorrhoids. *Count before ether, 7,500. Count after ether but before operation, 8,400. Count after operation, 14,500.*

CASE 49.—Operation, Cervix uteri. *Count before ether, 7,800. Count after ether but before operation, 10,400. Count after operation, 21,400.*

CASE 50.—Operation, Vaginal operation. *Count before ether, 7,200. Count after ether but before operation, 8,000. Count after operation, 19,000.*

CASE 51.—Operation, Laparotomy. *Count before ether, 8,200. Count after operation, 25,000.*

CASE 52.—Operation, Breast. *Count before ether, 6,500. Count after operation, 21,600.*

CASE 53.—Operation, Vaginal. *Count before ether, 8,000. Count after operation, 24,000.*

CASE 54.—Operation, Amputation of cervix. Count before ether, 7,000. Count after ether but before operation, 8,800. Count after operation, 11,500.

CASE 55.—Operation, Dilating and curetting. Count before ether, 6,800. Count after ether but before operation, 8,200. Count after operation, 19,400.

CASE 56.—Operation, Tumor in nose removed. Count before ether, 8,800. Count after ether but before operation, 8,000. Count after operation, 8,400.

CASE 57.—Healthy medical student. Count before ether, 8,200. Count after ether but before operation, 9,600. Count after ether, 7,800.

II. *Postoperative Leucocytosis*.—After operation, the leucocyte count was increased 2000 or more in thirty-five out of forty-seven cases, and 3000 or more in twenty-seven cases. This increase was in twenty-four cases, or one-half of all, a relatively slight one, amounting on the average to not more than 20 per cent., and in five cases there was an actual decrease. In a few cases leucocytosis was considerable; for example, (a) case of stone in the kidney: before operation, but after complete etherization, 7200; four hours later, after operation, 27,300; next morning, 13,700. Temperature, 101° F. (b) Nephrectomy. Before operation, but after ether, 15,400; after operation, 21,200. As a result of our counts in forty-seven cases, we conclude that operation has by itself a considerable tendency to increase the leucocyte count in about one-half the cases, while in the remaining half no leucocytosis of importance occurs. Regarding the duration of the postoperative leucocytosis which occurred in our cases, we have accurate notes in only ten cases. In these it appears that within thirty-six hours from the time of the operation the postoperative leucocytosis has generally disappeared. In seven of our ten cases the count on the day following the operation was lower than on the morning of the operation.

III. *Fractures*.—Experiments have shown that a leucocytosis can be produced in animals by a simple fracture. To investigate the possibility of a similar leucocytosis following fractures in human beings, we have made thirty-two counts in twenty-three cases of simple fractures, including five of the

leg, three of the fibula, two of the ribs, three of the radius, one of the patella, one of the pelvis, one of the spine, one of the astragalus, etc. In these cases there are ten showing a leucocyte count of more than 10,500, but in only six did the count reach above 12,000. The highest counts were 15,400 in fracture of the pelvis, 14,800 in fracture of the leg. As a result of these counts, it would seem that simple uncomplicated fractures seldom increase the leucocyte count to any considerable extent. In one case of fracture of both bones of the leg in which fat embolism was suggested by lung symptoms and signs, the leucocyte count rose to 15,600, falling next day to 10,600. In one case of fracture of the ribs with injury to the lung, the count made two days after the injury showed 14,900 white cells. A compound fracture of the leg counted two hours after the injury showed only 5400.

TABLE II.

TABLE OF CASES OF COUNTS OF THE LEUCOCYTES AFTER FRACTURES.

CASE 1.—*Bones broken* (?). *Counts*, 9,200 same day; 10,200 next day.

CASE 2.—*Bones broken*, Fractured nose. *Counts*, 15,600, same day; 10,100 next day. *Remarks*, Hæmorrhage.

CASE 3.—*Bones broken*, Colles' fracture. *Count*, 10,800. *Remarks*, Left hospital before second count.

CASE 4.—*Bones broken*, Compound fracture of tibia. *Counts*, 10,400 same day; 7,300 next day.

CASE 5.—*Bones broken*, Both bones of leg. *Counts*, 6,800 same day; 5,000 next day.

CASE 6.—*Counts*, 6,400 same day; 5,900 next day.

CASE 7.—*Counts*, 10,700 same day; 8,400 next day.

CASE 8.—*Bones broken*, Fracture of fibula. *Counts*, 11,600 same day; 8,800 next day.

CASE 9.—*Bones broken*, Both bones of leg. *Counts*, 11,300 same day; 8,200 next day. *Remarks*, Ether.

CASE 10.—*Bones broken*, Fracture of ribs. *Counts*, 7,900 same day; 8,100 next day.

CASE 11.—*Bones broken*, Fracture of clavicle, rib, and scapula. *Counts*, 9,900 same day; 8,600 two days later.

CASE 12.—*Bones broken*, Fracture of astragalus. *Count*, 10,800.

CASE 13.—*Bones broken*, Fracture of patella. *Count*, 8,800.

CASE 14.—*Bones broken*, Fracture of fibula. *Count*, 11,200.

CASE 15.—*Bones broken*, Fracture of patella, March 20. *Count*, 9,600, March 21, 9.05 A.M. *Remarks*, No ether.

CASE 16.—*Bones broken*, Fracture of scapula, February 19. *Count*, 12,500, February 20, 3.45 P.M. *Remarks*, No ether.

CASE 17.—*Bones broken*, Fracture of leg, February 21. *Count*, 13,100, February 22, 4.20 P.M. *Remarks*, No ether.

CASE 18.—*Bones broken*, Fracture of astragalus, March 15. *Count*, 11,400, March 16, 12.15 P.M. *Remarks*, No ether.

CASE 19.—*Bones broken*, Fracture of fibula, February 14. *Counts*, 8,600, February 15, 11.30 A.M. *Remarks*, No ether.

CASE 20.—*Bones broken*, Fracture of fibula, February 13. *Count*, 13,600, February 15, 12 M. *Remarks*, No ether.

CASE 21.—*Bones broken*, Fracture of pelvis, March 31. *Count*, 15,400, April 2, 11.30 A.M. *Remarks*, No ether.

CASE 22.—*Bones broken*, Fracture of spine, April 2. *Count*, 14,600, April 3, 11.45 A.M. *Remarks*, No ether.

CASE 23.—*Bones broken*, Fracture of leg, April 4. *Count*, 10,100, April 5, 11.45 A.M. *Remarks*, No ether.

CASE 24.—*Bones broken*, Fracture of leg, April 6. *Count*, 14,800, April 8, 11.45 P.M. *Remarks*, No ether.

CASE 25.—*Bones broken*, Fracture of clavicle, ribs, injury to lung, March 16. *Count*, 14,900, March 18. *Remarks*, No ether.

CASE 26.—*Bones broken*, Compound fracture of leg, March 22, 9.15 A.M. *Count*, 5,400, March 22, 11.30 A.M. *Remarks*, No ether.

CASE 27.—*Bones broken*, Fracture of thigh, March 25. *Count*, 14,260, March 26, 12.10 P.M. *Remarks*, Ether, March 25, P.M.

CASE 28.—*Bones broken*, Compound fracture of arm, fracture of scapula. *Count*, 13,000, March 5, 12.15 P.M. *Remarks*, Ether, March 4, P.M.

CASE 29.—*Bones broken*, Fracture of skull, scalp wound, February 16, P.M. *Count*, 12,100, February 17, 10.50 A.M. *Remarks*, No ether.

CASE 30.—(Baby.) *Bones broken*, Greenstick arm, put up February 11. *Count*, 15,200, February 12, 10.30 A.M. *Remarks*, Ether, February 11.

CASE 31.—*Bones broken*, Impacted hip, February 4. *Count*, 11,600, February 12. *Remarks*, Ether, February 4.

CASE 32.—*Bones broken*, Fracture of leg, February 4. *Count*, 6,600, February 12. *Remarks*, No ether.

CASE 33.—*Bones broken*, Impacted hip, four and one-half weeks ago. *Count*, 6,800.

CASE 34.—*Bones broken*, Fracture of both bones of leg, January 30. *Counts*, 15,600, February 2; 10,600, February 3. *Remarks*, Fat embolism (?).

CASE 35.—*Bones broken*, Pott's fracture, April 22 or 23. *Count*, 5,850, April 24, 11.20 A.M.

IV. *Blood Regeneration after Operations for Malignant Disease*.—Bierfreund (Langenbeck's *Archiv*, Vol. xli) makes the astonishing statement that after operations for malignant disease the hæmoglobin never reaches the point at which it

was before operation. To determine the correctness of this curious statement, we examined thirteen cases of cancer, and arrived at results wholly opposed to those of Bierfreund. Thus in a case of cancer of the breast, the hæmoglobin on February 23 was 70 per cent., and on March 18, after operation, the hæmoglobin was 85 per cent., and in five cases entering the hospital for a second time after a recurrence of a cancerous growth, the hæmoglobin averaged 87 per cent. In no one of them was it markedly diminished.

TABLE III.

TABLE OF CASES OF HÆMOGLOBIN REGENERATION AFTER OPERATIONS FOR MALIGNANT GROWTH.

CASE 1.—*Disease, Mammary cancer. Hæmoglobin before operation, 70 per cent. Hæmoglobin after operation, 70 per cent. Time elapsed, Ten days.*

CASE 2.—*Disease, Mammary cancer. Hæmoglobin before operation, 90 per cent. Hæmoglobin after operation, 80 to 90 per cent. Time elapsed, Six days.*

CASE 3.—*Disease, Cancer of uterus. Hæmoglobin before operation, 80 per cent. Hæmoglobin after operation, 90 per cent. Time elapsed, Four days. This case simply curetting and cauterizing the growth.*

CASE 4.—*Disease, Cancer of cervix. Hæmoglobin before operation, 90 per cent. Hæmoglobin after operation, 80 per cent. Time elapsed, Ten days.*

CASE 5.—*Disease, Recurrent cancer in vagina after hysterectomy in August, 1900. Hæmoglobin before operation, 90 per cent. Hæmoglobin after operation, 90 per cent. Time elapsed, Six days.*

CASE 6.—*Disease, Cancer of left breast. Recurrence. Hæmoglobin after operation, 90 per cent. Hæmoglobin after operation, 90 per cent. Time elapsed, March, 1896, to October, 1899. Recurrent nodules. Removed May and November, 1900. Time elapsed, Six days.*

CASE 7.—*Disease, Recurrent cancer, second operation. Hæmoglobin before operation, 90 per cent. Hæmoglobin after operation, 90 per cent. minus. Time elapsed, Eight days. First operation February, 1900; second operation, November, 1900.*

CASE 8.—*Disease, Cancer of breast. Hæmoglobin before operation, 90 per cent. Hæmoglobin after operation, 90 per cent. Time elapsed, Second operation, May 21, 1899; time elapsed, eight days.*

CASE 9.—*Disease, Cancer of breast. Hæmoglobin before operation, 80 per cent. Time elapsed, Second operation, December 1, 1900; Count, April 8.*

CASE 10.—*Disease, Cancer of uterus. Dermoid ovary. Hæmoglobin before operation, 80 to 90 per cent. Hæmoglobin after operation, 90 per cent. Time elapsed, Eighteen days.*

CASE 11.—*Disease*, Second operation for osteosarcoma of thigh. *Hæmoglobin before operation*, 100 per cent. *Hæmoglobin after operation*, 90 per cent. *Time elapsed*, Eight days.

CASE 12.—*Disease*, Malignant disease of stomach. Extensive cancer. Exploratory laparotomy. *Hæmoglobin before operation*, 50 per cent. *Hæmoglobin after operation*, 45 per cent. *Time elapsed*, Twenty-two days, general condition worse.

CASE 13.—*Disease*, Carcinoma of lips. *Hæmoglobin before operation*, 80 per cent. *Hæmoglobin after operation*, 80 per cent. *Time elapsed*, Eight days.

V. *Variations of the Counts in Cases of Typhoid Fever examined from Hour to Hour*.—In the writings of Cushing, Thayer, and others, considerable stress has been laid upon the occurrence of a short "wave" of leucocytosis as suggestive of perforation of the intestine. This wave of leucocytosis has been apparent in some cases only when hourly or half-hourly counts were made, and would have been altogether overlooked had counts been made only once or twice in twenty-four hours. It appears to us that such a wave of leucocytosis may, and probably does, occur in many conditions other than intestinal perforation, and even without any recognizable pathological lesions. Thus, in a convalescent typhoid were recorded the following counts:

4.15 P.M., Leucocytes, 10,100.

5.15 P.M., Leucocytes, 5,800.

6.05 P.M., Leucocytes, 9,060.

In a healthy subject, thirty-one years of age, the following counts were recorded:

5.15 P.M., Leucocytes, 5700.

5.30 P.M., Leucocytes, 6600.

5.50 P.M., Leucocytes, 7700.

6.05 P.M., Leucocytes, 8400. (So far is to be observed a steady increase.)

6.15 P.M., Leucocytes, 5400.

In view of these and similar variations observed in ten other cases (four of which were cases of typhoid fever), we believe it is unsafe to base any inferences regarding diagnosis and treatment upon such temporary "waves" of leucocytosis. That leucocytosis usually exists in typhoid perforation we

are well aware, but in order to be of diagnostic value such leucocytosis must be relatively steady and not of the type described by Cushing.

TABLE IV.

TABLE OF CASES OF FREQUENT LEUCOCYTE COUNTS IN TYPHOID FEVER AND IN HEALTH.

CASE 1.—*Diagnosis*, Typhoid, third week. *Hour and Count*, 11 A.M., 8,200; 12 M., 10,300; 1 P.M., 12,200; 2 P.M., 10,300; 3 P.M., 11,400; 4 P.M., 15,400; 5 P.M., 7,500; 6 P.M., 28,800; 7 P.M., 10,600. *Remarks*, Several hæmorrhages before, during, and after counts. No perforation. Recovery. Steady improvement after counts.

CASE 2.—*Diagnosis*, Typhoid. *Hour and count of whites*, Entrance, 6,300; eight days later, September 15, 9.20 A.M., 8,800; 10.25 A.M., 14,300; 12.20 P.M., 12,800; 1.20 P.M., 10,600; 2.20 P.M., 8,400; 5.20 P.M., 10,600; 8.10 P.M., 14,300; 10 P.M., 1,300. September 16, 8.15 A.M., 20,200; 10 A.M., 22,000; 11 P.M., 18,800. September 17, 9.45 A.M., 9,000. *Remarks*, Boy, fifteen years; twelve days' duration at entrance. At 6 A.M. sharp abdominal pain, no vomiting; one hour later, chill. 8.45 A.M., slight general distention. 1 P.M. subnormal, anxious expression, pain. Parents refused operation. September 17, 10.20 A.M., died. Symptoms of general peritonitis.

CASE 3.—*Diagnosis*, Typhoid. *Count*, 13,300. *Remarks*, Woman, eighteen years; sixth week. Sudden pain and swelling in leg; phlebitis.

CASE 4.—*Diagnosis*, Typhoid. *Count*, 4,200; 8.30 A.M., 8,600; 1.30 P.M., 5,500; 5 P.M., 3,200; 8 P.M., 5,000. *Remarks*, Boy, sixteen years. Admitted, September 14; one week's duration. Perforation, September 26, chill at 3.30 A.M. Transferred to surgical operator. Lived four days. No general peritonitis at operation.

CASE 5.—*Diagnosis*, Typhoid. *Hourly count*, First, 6,400; second, 6,600; third, 6,000. *Remarks*, Five days before hæmorrhage and death.

CASE 6.—*Diagnosis*, Typhoid. *Hour and count*, 3.45 P.M., 11,000; 4.45 P.M., 9,060; 5.35 P.M., 9,300.

CASE 7.—*Diagnosis*, Typhoid relapse. *Hour and count*, 4 P.M., 15,000; 5 P.M., 14,400; 5.50 P.M., 11,400.

CASE 8.—*Diagnosis*, Convalescent typhoid. *Hour and count*, 4.15 P.M., 10,100; 5.15 P.M., 5,800; 6.05 P.M., 9,060.

CASE 9.—*Diagnosis*, Typhoid. *Hour and count*, 4.30 P.M., 7,100; 5.20 P.M., 7,400; 6.20 P.M., 5,600.

CASE 10.—*Diagnosis*, Typhoid. *Hour and count*, 9.35 A.M., 7,300; 10 A.M., 5,100; 10.25 A.M., 5,700; 11.25 A.M., 6,850.

CASE 11.—*Diagnosis*, Typhoid. *Hour and count*, 1 P.M., 6,600; 2 P.M., 6,600; 3 P.M., 6,800.

Diagnosis, Normal health. *Hour and count*, 4.30 P.M., 11,000; 4.45 P.M., 9,200; 5 P.M., 7,000; 5.15 P.M., 10,100.

Diagnosis, Normal health. *Hour and count*, 5.15 P.M., 5,700; 5.30 P.M., 6,600; 5.50 P.M., 7,700; 6.05 P.M., 8,400; 6.15 P.M., 5,400.

VI. *Leucocytosis after Severe Muscular Exertion.*—

Finally, we think it may be of interest to put on record the following observations made upon four of the runners in a recent "Marathon race" of about twenty-four miles, which took place April 19, 1901. All the cases showed a very marked increase in the white cells. In one case the leucocytes rose from 3700 before the race to 20,800 after it. (See Table below.)

But still more interesting were the changes revealed by the differential count, which showed a very marked, absolute, and relative increase in the polymorphonuclear neutrophiles, with a corresponding diminution of the lymphocytes and an entire absence of the eosinophiles in three cases out of four, while in the fourth they were greatly reduced. In one case atypical forms of leucocytes, not to be observed in normal blood, were present.

The details of these counts are shown in the following table:

TABLE V.
DIFFERENTIAL WHITE COUNT BEFORE AND AFTER THE RACE.

Leucocytes before race.	Leucocytes after race.	Differential white count after the race.					
		Polymorpho- nuclear neutro- philes.	Large mononu- clear and transit.	Small mononu- clear.	Eosinophiles.	Myelocytes.	
Three days be- fore, 9800; immediately before, 4800.	14,400		4	5.7	0	0	Reds normal. No eosino- philes found in two cov- erslip spreads. Hæmo- globin, 105 per cent.
Two days be- fore, 5800.	16,200		4.7	4	0	0	Hæmoglobin, 98 per cent. Reds normal in size, some irregularity in staining. Among the forms classed as poly- morphonuclear neutro- philes were an unusual number whose nuclei were but partly divided, and rarely one almost a myelocyte. No typical myelocytes.
		90.3					
		91.3					
Immediately before, 3700.	20,800	84.4	8	7.2	0.4	0	Hæmoglobin, 90 per cent. Reds normal.
Three days be- fore, 8.30 P.M., 8200.	22,200	86	7.3	6.7	0	0	Hæmoglobin, 100 per cent. Some variability in coloring of reds. Reds otherwise normal.

To capitulate briefly:

(1) At the end of complete anæsthesia, there is occasion-
ally a slight increase of leucocytes, but seldom a marked leuco-
cytosis.

(2) At the end of operation, there is a considerable leu-
cocytois in one-half the cases, and in almost all cases some
increase beyond that found at the end of complete anæsthesia.

(3) Simple uncomplicated fractures seldom increase the
leucocyte count to any considerable extent.

(4) The blood after operation for malignant growths
is not necessarily much impoverished, and regenerates, in
favorable cases, quite normally.

(5) A variation in the hourly leucocyte count exists in

other conditions than the preperforative stage of typhoid, and may occur in health.

(6) Very violent physical exertion produces in the blood a condition which leaves physiological limits, and approaches or is identical with that found in disease.

The writers desire to thank the Staffs of the Massachusetts General Hospital, the Boston City Hospital, and St. Elizabeth's Hospital for permission to study cases under their care. At the Boston City Hospital, white counts were made by W. H. McBain, D. A. Heffernan, J. H. Mullin, and R. C. Thompson. At St. Elizabeth's Hospital, by Drs. J. J. Sullivan and T. F. Hanna. Differential counts of Marathon runners by Dr. R. C. Larrabee.

FREQUENCY OF RECURRENCE OF SARCOMA,¹
WITH ESPECIAL REFERENCE TO AMPUTATION AT THE HIP-JOINT
ON ACCOUNT OF THIS NEOPLASM.

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THE surgeon of large experience cannot fail to be impressed with the extremely malignant character of sarcoma as shown by the frequent recurrence of this neoplasm, either locally or remotely. This is true whether the tumor is removed by dissection without amputation, or when an amputation is made more or less remote from the growth. What I have to say here does not refer to that rare and most fatal variety of this neoplasm known as the melanotic sarcoma, but of the three ordinary surgical forms, the round, the spindle-cell, and the myeloid or giant-cell varieties. For a while I thought that perhaps I was unusually unfortunate in dealing with these cases, but in later years a study of the reports of other surgeons convinces me that my experience was not exceptional; that in fact sarcoma was the most malignant form of neoplasm.

In my own practice I can now recall but two cases which in strict propriety can be claimed as cured, and to these I will call especial attention. I have a number of patients still surviving, one now in the fourth year after a hip-joint amputation with no sign of recurrence; but I cannot yet count this case as cured, for I have under observation, also, a man at whose shoulder-joint I amputated five years ago for an osteo-

¹ Read before the Philadelphia Academy of Surgery, April 1, 1901.

sarcoma of the upper end of the humerus, but which five months ago recurred in the stump. This and other cases show how fallacious it is to pronounce as cured patients who have once become the victims of this unfortunate disease.

Within the last twelve months, while engaged in collecting the cases in which amputation at the hip-joint had been performed by my method, I was impressed with the frequent recurrence of sarcomata in the lungs or other viscera, and occasionally in the stump, even when the disease was seemingly entirely confined to the bone and well removed from the line of incision in forming the flaps.

Out of 267 cases of amputation at the hip by this method there were 131 done on account of sarcoma, fourteen of these, or 10.6 per cent., ending fatally, wholly or in part as a result of the operation. This ratio of mortality is in my opinion large, for the reason that in several of the fatal cases there were complications grave enough to have rendered success practically impossible. Gangrene existed in one instance for two weeks before the operation, the patient being *in extremis*, and showing a rectal temperature of 104° F. at the time of amputation, dying in shock soon after. Another case was in collapse and practically hopeless by reason of severe hæmorrhage which occurred, due to breaking down of a large vascular osteosarcoma; a third case recovered from the operation but died from what was termed "tubercular peritonitis" on the eleventh day; while a fourth case, after a good recovery from the operation, suffered pyogenic infection of the flaps and died from septicæmia on the twenty-sixth day. In one other fatal instance the disease involved the tissue so high up that the acetabulum and the pelvis were infiltrated, necessitating curettage of an extensive region above the tourniquet, and followed by death in shock four hours later. A sixth case is included in the death list, although the patient succumbed from asphyxia on the twelfth day, the positive cause of death not being disclosed, but in all probability due to rapid infiltration of the lungs with the sarcomatous elements. There were, however, no complications in eight of the fatal cases, dying from four to twenty-six hours

after the operation, most of them in shock, and no doubt death was due in very great measure to this formidable procedure.

If the complicated cases were eliminated and only the eight fatal and uncomplicated cases considered, the death-rate would be 6 per cent.; and Mr. Thomas Chavasse, of the Birmingham General Hospital, in an excellent paper on amputation at the hip-joint, in the London *Lancet* of July 21, 1900, asserts that in properly selected cases the death-rate by this method should in future not exceed even this low percentage.

Of the 117 cases which survived operation, I have obtained more or less satisfactory histories of eighty-three. In fifty-two of these it is noted that the disease recurred, but since, in one instance, the neoplasm could not be entirely removed, this case is properly excluded. There are then a total of fifty-one, or over 63 per cent., ending fatally by recurrence.

If, however, a careful analysis of the cases in which the disease returned is made, it is evident that this estimate of the ratio of recurrence is too low, for in many of the cases classed in the non-recurring list so short a period of time had elapsed since the operation, that judging by the statistics in the recurring tables, the large majority of these will without doubt ultimately be added to the list of fatalities. Thus, of the fifty-one recurring cases, twenty-seven returned between one month and twelve months after amputation, while in five out of the twenty-nine cases reported as not having recurred when last heard from, only three, four, six, eight, and twelve months respectively had elapsed since the operation.

From the list of cases upon which this paper is based one may infer that the location of the tumor, that is, its proximity to the line of incision, in forming the flaps, or the fact of its being confined to the bone, endosteal or periosteal or involving the soft parts, has little, if any, influence upon the ultimate safety of the patient. Thus of the five patients operated upon by the writer, in the case which longest survived, the man being now alive and well three years after operation, the tumor began as an osteosarcoma at the great trochanter and immediately below this point, and by periosteal extension had

infiltrated the soft parts as high as the obturator foramen, from which a very considerable mass of the sarcomatous material was curetted. It seemed, in fact, the most unfavorable of all my cases. In another, seemingly ideal for the reason that the tumor was an osteosarcoma, and confined to the bone just at and above the condyles, with fully sixteen inches from the upper limit of the mass to the hip-joint, the patient survived only twelve months, dying from recurrence in the lungs, the stump remaining uninvolved. In another instance a neurosarcoma of the internal popliteal nerve recurred in the soft parts at the knee, and again at the middle of the thigh; and then, when a hip-joint disarticulation was done, the stump escaped, the disease recurred in the lungs, causing death eleven months after the last operation.

Two other of my cases of osteosarcoma of the femur, one a girl of seventeen and the other a youth of twenty, died respectively six months and thirteen months after the operation from recurrence in the lung with no involvement in the stump.

Professor Charles B. Nancrede reports five cases, the longest survival being a girl of fifteen, who was living, at last account, two years after the operation. Of the other four, a man, thirty-two years of age, died in six months from recurrence in the stump; another man, thirty-five years old, died within a year, the stump being involved; a third, a man thirty years old, died from recurrence in the lungs and brain sixteen months later, while a girl of sixteen had the neoplasm recur in the stump with general metastasis before death, nine months after operation.

Of the three cases of Mr. Thomas Chavasse that survived operation on account of sarcoma, two were endosteal and one of periosteal origin. There was no recurrence in the stump in either case, but the disease returned in the left lung in one endosteal case thirteen months later; in both lungs in the other case of endosteal origin, while the periosteal sarcoma ended fatally eleven months with recurrence in both lungs.

Among the encouraging cases, the longest survival (nine years and still in good health), the disease was a myelosarcoma

of the neck of the femur in a boy of fourteen, operated upon by Dr. Harry M. Sherman, of San Francisco.

In an unusually interesting case by Professor J. D. Griffith, of Kansas City, in which an enormous osteosarcoma extended from the trochanter down to near the knee, the patient still survives, four years after the operation, although the flaps were taken from immediately over the location of the growth. On the other hand, in a case operated upon by Professor H. H. Grant, of Louisville (a surgeon of large experience and well-known skill), in a man of forty-three years, the tumor being at the knee and well away from the line of operation, death ensued fourteen months later from recurrence in the lymphatics of the abdominal wall just above Poupart's ligament.

Of the eighty-three cases, twenty-nine are reported as not having returned. The longest surviving case which may be justly counted as a cure is that reported by Dr. Harry M. Sherman, of San Francisco, California, in a boy of fourteen, for myelosarcoma of the neck of femur, the patient being now alive and well, nine years after the operation.

Two cases survived seven years, one for osteosarcoma of the condyle of femur, by Dr. W. C. Dugan, of Louisville, Kentucky, still living at this date; while the second case, a boy of fifteen, by Dr. A. M. Phelps, of New York City, was living seven years after operation when last heard from two years ago.

There are also two in the five-year list, one still surviving and well at this date, by Dr. L. L. Shropshire, of San Antonio, Texas, the patient a negro of twenty years, the sarcoma involving the lower and middle third of the femur. In the second case the history terminated one and a half years ago, a girl of seventeen years at time of operation, having periosteal sarcoma of the femur, was living and well five years after operation.

Three survived four years. One of these, by Dr. J. D. Griffith, of Kansas City, in a male twenty-one years of age, was of enormous size, extending from the trochanter nearly to the knee, the flaps being cut from immediately over the neoplasm. There is no recurrence at this date. The other two

cases were living and well when last heard from four years after operation. One by Dr. Leonard Freeman, a central osteosarcoma of the lower third in a man forty-seven years of age; the other by Dr. D. C. Hawley, of Vermont, an osteosarcoma of the femur in a man twenty-one years of age.

Three cases are in the three-year group without recurrence. One by the writer, situated at the great trochanter, the neoplasm having spread to the soft parts as high as the obturator foramen, from which the disease was curetted. This patient is living and well now three years after the operation, and will be again referred to. In the other two cases the histories are not complete, one by Dr. Robert Weir, with no recurrence when last heard from, and another by Dr. F. A. Duns-moor, a man of twenty-five years for sarcoma of the lower end of the femur, had not returned when the history closed.

Three cases were surviving two and a half years after operation. One, a boy of six years, by Dr. A. M. Phelps, was living and well when last heard from two years ago. The other two of this group are still living at this date. One by Dr. J. D. Griffith, a child of five years, and a woman of thirty-five years operated upon in 1898 by Dr. Charles K. Briddon.

Nine cases are reported as surviving two years. Those living and well at this date are, one by Dr. J. D. Griffith in a child of nine years; another by Dr. Charles S. Hamilton, of Columbus, Ohio, a woman of thirty-two years, who is not only well at this date, but has borne a healthy child since the operation. The other cases were living when last heard from, but the histories are not complete, as the patients were lost sight of. One a woman of twenty-six years, operated upon in 1892 by Dr. Frank Hartley; a woman of twenty-four years, by Dr. W. N. Van Lennep, of Philadelphia, in 1895; a man of thirty years, by Dr. Charles K. Briddon; a man of thirty-five years, by Dr. R. W. Stewart in 1895; a woman of twenty-nine years, with periosteal sarcoma, by Mr. George Heaton; a man of thirty years, operated upon in 1897 by Dr. H. P. Cooper; and a girl of sixteen years, by Dr. Charles B. Nancrede, 1894.

One case, a woman of twenty-four years, having sarcoma

of the soft parts of the thigh, operated upon by Dr. W. B. Coley in 1898, was surviving eighteen months later.

One case, a child of five months with myxosarcoma of the knee, was well fourteen months later when last heard from, the operator being Dr. F. W. Parham, of New Orleans.

One case by Dr. E. W. Holmes, a man of twenty-three years of age, with osteosarcoma of the femur, had no recurrence at last report, one year after the operation.

Dr. M. B. Herrman reports no recurrence in a man twenty-four years of age, eight months after operation.

Dr. W. B. Coley operated upon a man of forty-five years for osteosarcoma, with no recurrence at last report six months after operation, while in Dr. Charles McBurney's case no recurrence had taken place three months later, when the patient was last heard from, the operation being done in 1890, on a man of thirty-four years, for osteosarcoma of the femur.

The cases which recurred fatally with the period of immunity are as follows: One a boy of eighteen years for sarcoma of the thigh, operated upon by Dr. Frank Murray, of New York, in 1894, with death from recurrence in the lung four years after operation. Case 2, a woman of thirty years, operated upon in 1892 by Dr. W. W. Keen; patient lived three and one-half years, and died from recurrence, most probably in the abdominal viscera, as there was no mention of involvement of the lungs in the report. This case has an additional interest, being one of two cases of pregnancy when the operation was performed, the woman going to term and giving birth to a healthy child.

Five cases survived two years, one by Dr. W. B. Coley, in a girl of thirteen years, chondrosarcoma of the femur recurred fatally in two years, location of recurrence not given. Another by Dr. Vinke, girl of sixteen years, recurred in the stump and mesenteric glands; another by Dr. Van Lennep, in a girl with recurrence in the lung, and a fourth case by Dr. L. L. Hill, of Montgomery, Alabama, osteosarcoma of the femur forty-four inches in circumference, male, thirty-five years of age, recurred in the stump. A fifth, by Dr. Carl Beck, of New York, an

osteosarcoma of the femur, woman fifty-four years of age, recurred in the lung and pleura.

One case by Dr. A. C. Bernays, lad of eighteen years, for sarcoma of the thigh, survived twenty months, died from recurrence in the lung.

Seven survived eighteen months. One sarcoma of the soft parts recurred in the stump and iliac fossa; a second recurred at the sacro-iliac synchondrosis; third recurred in the lung; fourth in the pleura; fifth in the liver; sixth in the abdominal viscera; seventh in the lung.

One case survived sixteen months, recurring in lung and brain.

One fifteen months, with recurrence in the lung.

Three survived fourteen months. One recurred just above Poupart's ligament; second recurred in the stump, and a third in the lung.

Two survived thirteen months, both dying from recurrence in the lung.

Five survived one year. One by the writer, osteosarcoma of the lower third of the femur, recurred in the lung; a second case returned in the lungs, and a third recurrence, location not stated; fourth recurred in the scalp, orbit, and elsewhere, and fifth in the glands and viscera of the abdomen and chest.

Three cases are reported as having died "within a year;" one recurring in the stump, another case of sarcoma of the soft parts of the thigh in the lung, and a third by Dr. McRae, in a lad of seventeen years, for osteosarcoma from recurrence in the pleura near the pericardium.

Four cases survived eleven months, two recurring in the lungs, one in the liver; the fourth, location of recurrence not stated.

Two survived nine months, one dying from general metastasis; second, from recurrence in the lungs.

One case recurred fatally in eight months, the stump being intact. At time of operation this case, however, suffered from lancinating pains in the chest.

One recurred in the abdominal viscera seven months after operation, the stump being intact.

Eight cases survived six months. Three recurred in the stump, three in the lungs, one in the lungs and abdomen, and one probably in the brain, as the patient died from apoplexy as was reported.

In addition to the foregoing, one case is reported as having perished several months from recurrence, location not given, died in a few months, the disease having been left in the stump at time of operation.

Another recurred "very early" in the lungs, while another died in a few months, the disease having been left in the stump at time of operation.

The following summary gives the location of the recurring neoplasm: Lung, 23; lung and brain, 1; lung and pleura, 1; lung and abdomen, 1; pleura, 2; abdominal viscera, 3; liver, 1; abdomen and chest, 1; stump, 10; stump and mesenteric glands, 1; stump and general metastasis, 1; stump and iliac fossa, 1; lymphatic, just above Poupart's ligament, 1; sacro-iliac synchondrosis, 1; location not given, 4; apoplexy, 1. Total, 53.

In concluding these statistics, deplorable enough, yet not so unfavorable as those submitted by others who have made a study of sarcoma of the long bones, I desire to add the following cases from my personal experience.

On the 20th of May, 1884, W. P., thirty-three years of age, came under my care with the following history: About six months before this date he had been struck with the butt-end of a billiard-cue upon the abdominal wall, a little to the right of the median line and half-way between the pubes and the umbilicus. The contusion caused him no special concern, and after two or three weeks of slight soreness and ecchymosis disappeared. At the end of two months, a small induration showed itself over the original point of injury. This gradually increased in size, was not painful, and when I saw him on the date above given there was a hard sessile mass extending from the level of the umbilicus

to just above the pubes, and spreading two inches to the left and four inches to the right of the median line. The tumor was adherent to the muscles and was not painful on pressure. The notes taken at the time say that the "patient is fairly well nourished, appetite is poor, bowels regular, tongue slightly coated." He states that "during the last two months he has lost flesh and strength." He had a specific urethritis fifteen years ago which left no complications, and five years later had three small chancroidal ulcers of the prepuce which healed under local treatment, and were followed by no secondary symptoms.

On the 21st of May, under ether, I made an exploratory incision and removed a considerable piece of the neoplasm for microscopical study, the section extending as deep as the centre of the tumor, which bled slightly, the hæmorrhage being readily controlled by packing. Examination of the section by Dr. William H. Welch, now of Johns Hopkins University, Dr. William L. Wardwell, a former pupil of Cohnheim's laboratory, and myself showed it to be a sarcoma. Having about this time noticed in the *Centralblatt für Chirurgie* a report of three cases of sarcoma which were claimed to have been cured by the repeated injection into the mass of arsenous acid, I obtained the consent of the patient to try this treatment after convincing him that his condition was hopeless without it. With the ordinary hypodermic syringe I injected into the tumor around its circumference two or three drops of Fowler's solution in one spot, and then going about an inch farther repeated the process two or three times. These injections produced very considerable pain, but were continued daily or every other day for two weeks, when, by reason of the inflammation they had already caused and the increasing pain, the patient begged me to desist, stating that he would prefer death to the suffering which the treatment entailed. By this time the tumor where the earlier injections had been made was swollen, exceedingly painful, œdematous, and red, although the redness did not have the bright or polish-like character of a true erysipelas. He was by this time running temperatures varying from 100° to 103° F. with all the concomitant symptoms of pyogenic sepsis. The injections were discontinued, warm local applications were made in order to produce suppuration and allay the inflammatory symptoms which the injections had induced, and on June 17, at his request, he was discharged and permitted to go to his home in the South. His

condition was so bad at this time that I scarcely hoped that he would survive much more than the trip home, and deeming him so utterly hopeless I did not think it necessary to make inquiry by letter when he may have died. I had no doubt, however, that he was dead. Imagine my surprise when, two years later, the physician who had sent him to me originally called upon me in New York and informed me the patient was living and in perfect health; that the sarcoma had disappeared, and there was nothing now to show for it except the scar in the integument caused by my exploratory incision. He has never had any recurrence of the growth, and was living a year ago in perfect physical condition and weighing 170 pounds, which was at least forty pounds more than he weighed when he was under my care in 1884.

I believe that this patient was cured by the streptococcus infection, local and general, which the injection of arsenous acid and the consequent bacterial invasion produced.

About this time there occurred another case in the experience of a distinguished colleague, Dr. A. G. Gerster, of New York, in Mt. Sinai Hospital, where we were then on duty. It was that of a young woman of twenty-two years of age who had a spindle-cell sarcoma of the thigh, for which an amputation was made. The disease recurred in the stump, and the patient was again admitted to the hospital, but after examination, it being very properly pronounced inoperable, she was discharged, and was to have left the hospital in a day or two. Symptoms of erysipelas meanwhile developed in the stump, and she was immediately removed to the isolation ward, where the inflammation rapidly spreading over the skin of the abdomen deeply infected the sarcomatous mass, which broke down and underwent extensive sloughing. No treatment was undertaken except to nourish the patient. She gradually recovered, all symptoms of the sarcoma disappeared. She is to-day in perfect health, sixteen years after the attack.

In August, 1893, Mr. J. P., thirty-five years of age, came into my private hospital suffering from a large tumor situated between the normal location of the gall-bladder and the middle line of the abdomen and extending from the edge of the liver as far as the umbilicus, pushing the abdominal wall forward and making an elevation of several inches above the ordinary level. This patient was very pale, greatly emaciated, and so feeble that he could not walk without assistance. He had been tapped for dropsy on three

or four occasions before he came to me, and on the day after he arrived in New York I removed by measurement five gallons of fluid from the peritoneal cavity by tapping between the umbilicus and the pubes. When the abdominal wall collapsed after evacuating this fluid, I could make out a hard, round, slightly movable tumor which was globe-shaped, with a transverse and antero-posterior diameter of about six inches, and probably eight inches in the longest measurement. In view of the hopelessness of his condition, I advised him to permit me as a last resort to explore by incision this tumor, and if I could not remove it with safety, to induce a pyogenic infection of the anterior surface of the mass. On the following day, August 23, 1893, this operation was done. I exposed the tumor by an incision five or six inches in length. It was quite firm to the touch and seemed to be developed from the gastrohepatic omentum, extending from the under surface of the liver immediately over the portal vein downward and to the left in the direction of the umbilicus. It had a net-work of large vessels on its anterior surface, none of which were divided in the exploratory operation. I did not undertake to do anything at this time except to pack the wound with non-sterile gauze. Infection and suppuration rapidly supervened, and within two weeks' time there was a very marked amelioration of the symptoms. The dropsy returned very slowly. He was tapped only on one other occasion, about six weeks after the operation, and about a gallon and a half of fluid were removed. The wound was kept open and suppurating for about two months, at the end of which time, as well as we could estimate, the tumor was about one-half of the original size.

Four years later he returned to me, having suffered severe hæmorrhages from the lower bowel, which I discovered were due to hæmorrhoids, and which I removed by operation. It is now four years since this last operation and eight years since the first infection of this neoplasm. The remnant of this tumor can still be felt, but it gives him no annoyance. He is an active man, being at this time mayor of the city of Augusta, Georgia, and president of a large corporation doing a business which requires the greatest activity. I saw him within the last four months, and he was seemingly in the best possible physical condition.

In the same month, when the preceding patient was under my care, Mr. J. L. consulted me in regard to a painful trouble

of the right upper jaw which he said had been pronounced an abscess, for the relief of which two or three of the upper jaw teeth of that side had been extracted, and an opening made into the antrum of Highmore, through which a small quantity of pus was discharging. Thinking that the diagnosis was correct, I enlarged the drainage opening, and advised that a plug of chewing gum be inserted into the hole when he was eating, so that foreign substances would not be driven into the antrum in the act of mastication. He did not improve as result of free drainage, and returned to me in January, 1894. I became suspicious, then, of malignant disease, and advised an exploration to determine this, to which he submitted. I removed enough of the upper alveolus to permit an exploration of the antrum maxillare, from which I curetted a suspicious-looking material, which being bathed in pus did not present the ordinary macroscopical appearance of sarcoma or carcinoma. I submitted this specimen with the history of the case to Professor J. Mitchell Prudden, of the pathological laboratory of the College of Physicians and Surgeons, New York, who reported that it was without doubt a sarcoma. I acquainted the patient with the result of the consultation, and advised a complete removal of the upper jaw, to which he immediately consented. The ordinary incision was made, the integument and the muscles lifted carefully, and all of the upper jaw removed, together with a portion of the soft palate, which I feared was involved. The incision in the roof of the mouth extended well over to the left side, and a portion of the vomer was taken away with the rest of the upper jaw of the right side. As the growth seemed to be attached more particularly to the roof of the antrum, especially to that portion forming the floor of the orbital cavity, I determined to remove this; and, in order to support the globe of the eye in its natural position, with a very delicate sharp chisel I cut away the floor of the orbit from the narrow margins of the orbital cavity formed by the maxilla, leaving a rim of bone not unlike the rim of a pair of spectacles, but removing the floor of the orbit behind this rim well back to the posterior limit of the antrum. The operation was the most extensive one of its character I have ever undertaken, but the patient recovered without any interesting complications.

The operation took place on the 1st of February, 1894, and on the 1st of March I began to induce in him a general strepto-

coccus infection. I employed at first Coley's mixture of the bacillus prodigiosus and the streptococcus of Fehleisen, and produced with this the usual febrile reaction. About this time a case of erysipelas came under the care of one of my assistants, and I determined to use the serum from this patient in the hope of inducing a general infection which would destroy any sarcoma cells which might have been left in the operative field or which might have been already transported to other parts by the veins or lymphatics. The serum from the blebs of the erysipelatous patient, three or four drops at a time, was thrown under the skin of the abdomen, but produced no pyogenic or streptococcus infection that was noticeable. The character of this man, his patient courage, and the fact that he desired to try every possible means to effect a cure without regard to any personal risk to himself, determined me to the extreme measure of inducing, if possible, a pronounced erysipelatous infection. With this end in view I secured from Dr. Buxton, of the Loomis Laboratory in New York, a very virulent quality of the streptococcus of Fehleisen which had been increased in intensity by being passed several times through the rabbit, and these I employed until at last from an injection into the thigh just above the knee I produced an erysipelas-like inflammation of the skin which, travelling in both directions, but chiefly upward, spread on to the abdomen as high as half-way from the umbilicus to the xiphoid appendix, chiefly upon the left side, it being the left thigh which furnished the point of inoculation. Through the whole months of March and April he bore this heroic treatment manfully, and, although considerably the worse for wear when it was over, he left for his home to await the results. They are such that to this date he is entirely well, is a busy and successful lawyer in active practice, and has had constructed an artificial jaw with a movable palate, and converses so well that one unacquainted with him before the operation could not detect any unnatural intonation of voice or impediment of speech.

In October, 1895, three or four days after a preliminary ligation of the left subclavian artery in its third surgical division under cocaine anæsthesia, which was done to arrest hæmorrhage from a large osteosarcoma of the upper end of the humerus of that side, under a general narcosis of ether I amputated the left upper extremity at the shoulder-joint, taking away the soft parts so thoroughly that there was no material to furnish the covering

for the stump, which, after the hæmorrhage was arrested by ligatures and compression, was left open for subsequent pyogenic infection. This healed slowly by granulation with extensive supuration, and two months after the operation I began to inject pure laboratory cultures of Fehleisen's coccus, producing well marked symptoms of streptococcus infection. I noticed in this case, as in the one I have just reported, that it was exceedingly difficult to induce an infection with Fehleisen's coccus until a week or two after a continuous injection of Coley's mixture, which seemed to break down the resistance of the tissues and permit the invading organisms of Fehleisen's coccus to take hold and produce their characteristic infection. Within the first six months of this amputation I infected the patient twice in this manner, and advised him to come for a few injections at least twice a year for the next two or three years. He came to my clinic to exhibit himself several times after this. On two occasions he was injected two or three times with the erysipelatous mixture. I did not see him, however, after 1898 until within about six months ago, when he returned, very much concerned about a swelling which was beginning to show itself just below the acromion process of the scapula in the scar which had covered over the wound of amputation. His condition, due, I believe, in a measure to alcoholic dissipation as well as to the recurrence of the disease in the stump, was bad. Being convinced that the sarcoma had returned, I advised him to submit to a thorough removal of the clavicle and scapula and the soft parts connected with them. He was placed in ether narcosis and an incision commenced a sufficient distance from the margin of induration. Fortunately, this incision was very slight, not more than four inches long and one-half inch deep, for the hæmorrhage was very profuse. There were no blood-vessels of any size, not even a spurt, and yet the wound bled so freely it was all I could do to control it by crowding in gauze, applying forcible compression. I waited from fifteen to twenty minutes to see if it would cease, but when the compression was removed it bled seemingly as profusely as ever. I saw then that I could not complete the operation, and abandoned it, packing the wound and permitting it again to become infected with pus organisms. I also had him return to my clinic, and introduced into the mass on three occasions from three to as high as ten drops at one time of Coley's mixture. I used on one other occasion the pure streptococcus,

two minims. This induced very marked reactions each time, and were followed by improvement in the condition of the tumor and in the patient's general condition. He is still up and about attending to his business, but has kept away from the surgeon for the last three or four months. The prognosis in this man's case is, of course, unfavorable, and I do not think he will survive more than a year.

I sincerely believe, since this is the only case in which I have ever done this amputation for sarcoma in which the patient survived longer than a year, that this man's life was prolonged by the streptococcus infection; and, finally, the only one of my five hip-joint amputations for sarcoma which survived over a year, and which still survives, three years after the operation, was permitted to become thoroughly infected with pyogenic organisms by leaving a large portion of the wound open and packing it with loose gauze.

That streptococcus toxæmia, either erysipelatous or pyogenic, has an inhibitory influence upon sarcomata I have no doubt; and since, almost without exception, in cases not subjected to this infection, recurrence is the rule, I am of the opinion it should be practised whether or not the case is operable; and when an extirpation or complete removal of the part involved by amputation has been made, infection should be induced, and repeated at intervals not longer than six months for at least six years after the operation.

TERATOMA OF THE TESTIS.¹

By WILLIAM B. COLEY, M.D.,

AND

BERTRAM H. BUXTON, M.D.,

OF NEW YORK.

THE patient who is the subject of the present report was a German, aged twenty-seven years, who has always been in perfect health. He states that up to eight months prior to December, 1900, he had noticed nothing abnormal in the right testis, and he had never received an injury as far as he remembers. About this time he observed a slight enlargement of the testicle. This increased uniformly, without pain, until the time of my first observation, December 10, 1900. Physical examination then showed a tumor about the size of an orange, symmetrical in shape, very firm in consistence, giving all the characteristics of a sarcoma of the testis, which was the clinical diagnosis made. The glands of the groin were not enlarged and general health was perfect. On December 12, I operated, removing the testis and the cord up as far as the internal ring. (See Fig. 3.) The wound healed without suppuration and the patient has been in good health since.

PATHOLOGICAL REPORT ON TUMOR OF TESTIS.—The tumor is about the size of an orange, the testis forming a flattened cap over the upper part. Both tumor and testis appear to be contained together in the tunica albuginea, although the former is enveloped by a separate capsule of connective tissue, from which the testis can be peeled off without tearing.

On section the tumor is found to consist chiefly of tough, semitranslucent material containing numerous minute cysts. (Figs. 2 and 3.) Microscopical examination shows a teratoma with all three germinal layers represented.

The *ectoderm* by cysts lined with flat, stratified granulosum and formation of horny material. Hair follicles and glandular appendages are absent.

The *mesoderm* by islands of hyaline cartilage with a tendency in a

¹ Read before the New York Surgical Society, March 27, 1901.

few places towards ossification; mucoid and spindle connective-tissue cells resembling those found in the embryo, and involuntary muscle fibres.

The *entoderm* by irregular, villous cysts lined with columnar epithelium and containing mucus. The larger cysts have lost their villousities, and the lining epithelium has become more or less flattened, presumably owing to pressure. The walls are composed of embryonic connective tissue interspersed with strands of involuntary muscle fibres.

In close connection with the entodermal cysts are masses of swollen hyaline cells, lying closely packed together in definite alveoli without any intercellular substance between them, and which may perhaps represent the *chorda dorsalis*. Wilms has observed these masses of cells in his cases, and supposes them to represent early stages of stratified epithelium, but their connection with the entodermal cysts seems to point to their being of a different nature. The entodermal cysts greatly exceed the ectodermal in number, and this condition was also observed by Wilms. And these different structures are heaped up together without any particular arrangement, so far as can be observed.

The tumor appears to be of a benign nature in that it is enclosed in a definite capsule, and the cells of which it is composed, although embryonic in character, seem to indicate progressive development rather than the regressive changes observed in carcinomas and sarcomas.

This case, though very rare, is interesting chiefly from a pathological stand-point, and a very careful report of the microscopical findings, illustrated by photographic reproductions of slides of the specimen, has been prepared by Dr. Buxton.

Wilms's paper (*Beiträge zur Pathologischen Anatomie*, Ziegler, Band xix) is undoubtedly the most complete and valuable work we have upon teratoid tumors of the testis, but we must remember that it was written entirely from the point of view of the pathologist.

The material upon which his paper is based comprises ten tumors of the testis observed by himself at the Pathological Institute of Giessen, and which he classes as "*Mischgeschwülste des Hoden*," and fifteen others, classed as dermoid cysts, that he has collected from literature. To show the confusion that has existed up to the present time, and still exists, as to the classification of these tumors, we need only to note that the original microscopical diagnosis in the ten cases which he classes as teratoid tumors was as follows:

The first case was classed as a myxosarcoma;

The second as a cystosarcoma;
The third as a carcinoma;
The fourth, mixed tumor of the testis;
The fifth, carcinoma;
The sixth, medullary carcinoma;
The seventh, cystoma;
The eighth, cystoid disease of the testis;
The ninth, cystosarcoma of the testis;
The tenth, teratoma, with malignant degeneration.

I do not think we should adhere too literally to the view of the pathologist, that these teratoid tumors are non-malignant. In two of Wilms's ten cases the subsequent history proved them to have been malignant, and in several of the remainder the after-history was not traced.

F. R. Sturgis, in 1899 (*American Medical Quarterly*), published a case of cystoid disease of testis, or a doubtful teratoma. The tumor was malignant, a carcinoma, and the patient died less than a year after. Sturgis has collected from the literature forty cases of cystoid disease and tabulated them. Of these forty cases, nine showed evidences of sarcoma; two of carcinoma, in the specimens removed. Sixteen, however, afterwards died of metastases; and, furthermore, the after-history of twenty-two others was not traced more than a few months after operation.

The conclusion must be that clinically these tumors are far more malignant than we are led to believe by the pathologists.

Teratomas may occasionally develop malignancy. Hudson, Welch's *Festschrift*, 1900, reports an adenocarcinoma arising from tracheal mucous glands in a sacral teratoma, and observes that this appears to be a unique case of glandular carcinoma in these tumors, since the few hitherto reported were of the squamous-celled variety. Wilms (*loc. cit.*), in ten specimens of teratoma of the testis, considered two to be clinically malignant; one because it formed secondary nodules in the neighborhood of the primary growth, and the other because secondary nodules developed in the liver some

time after operation on the primary tumor. Still, even in these two tumors there was no true infiltration of the neighboring tissues, such as there would be in carcinoma or sarcoma. So he concludes that histologically they would not be considered to show malignancy. Nevertheless, he admits that the tissues of teratomas may develop carcinomatous or sarcomatous degeneration, and for this reason should always be removed, even if there is no immediate danger on account of rapid growth.

Etiology of Teratomas or Embryomas.—Various theories have been advanced to account for their origin:

(1) Two ova are impregnated, one of which grows imperfectly and is incorporated by the other. This seems to account for acardiac parasites, and perhaps for those cases in which the tumor is found lying loose in the peritoneal cavity.

(2) Impregnation of one ovum with splitting off of one or more cells during segmentation before the establishment of the germ layers. Driesch showed in ascidians and echinoderms that in the two-cell stage of segmentation each cell, if separated from the other, is able to develop into a perfect embryo, which, however, is smaller than normal. Wilson in amphioxus, Hertwig and Schultze in amphibia, and others in various animals, have confirmed this, some observers showing that in the eight- and even the sixteen-cell stage a single separated segmentation cell is capable of producing an embryo normal in every respect save that of size.

Cephalic and sacral teratomas are ascribed to a similar process: the separated segmentation cells becoming enclosed in the process of enfolding of the medullary groove, and in later life producing a parasitic growth.

Next to the cephalic and sacral teratomas those of the ovary and testis are most frequent, but, in the present state of our knowledge of embryology, it is not easy to understand how separated segmentation cells can become incorporated in the genital organs, and in consequence the origin of these tumors has been ascribed by some authors to



FIG. 1.—*Teratoma of Testis*.—On the left are the tubules of the testis separated from the tumor itself by a band of connective tissue forming the capsule of the tumor.

In the tumor itself the dark areas are masses of cartilage. The cysts are seen in places encircled by a dark line. This dark line represents stratified epithelium, whilst those cysts in which it does not occur are lined by a single layer of cubical or columnar epithelium, the latter in some places ciliated.

The stroma, in which are scattered the cysts and islands of cartilage, is composed of embryonic-looking spindle-cells for the most part, whilst surrounding many of the cysts are layers of involuntary muscle fibres. Such cysts probably represent the intestinal tract, and their lining cells must be considered as of entodermal origin.



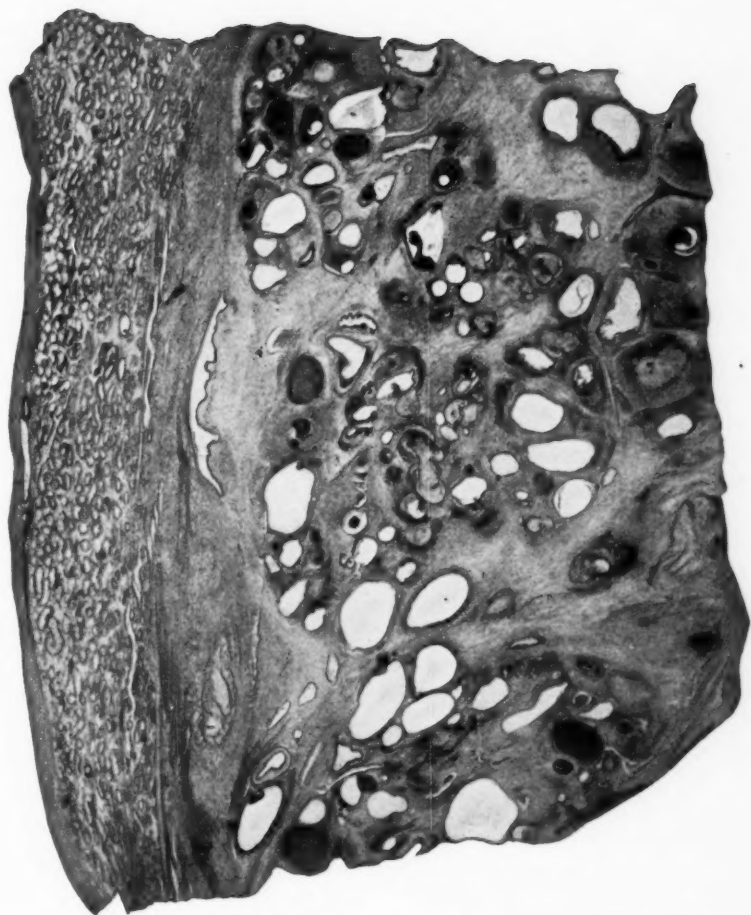


FIG. 2.—*Teratoma of Testis*.—Taken from the interior of the tumor. The islands of cartilage (dark areas) and cysts are here larger than at the periphery of the tumor. The connective-tissue stroma is more highly organized, as also are the bands of involuntary muscle fibres surrounding many of the cysts. These bands are visible in the print; staining somewhat deeper than the connective tissue.



(3) A partial hermaphroditism with consequent fertilization of an ovum in the genital organ itself. Wilms professes himself unwilling to speculate rashly on the origin of these tumors, but infers that, since all three of the germinal layers are represented, they must arise from an impregnated ovum. There are certain large cells lying in the interstitial tissues of the testis which Nussbaum supposed to be undeveloped primordial ova; but most observers believe them to be of connective-tissue origin; and Lockwood claims to have traced their development in the embryo from connective-tissue cells, while the fact that in those animals—boar, cat, etc.,—in which they are specially prominent, they vary considerably in different seasons of the year, points to their fulfilling certain unknown functions.

Wilms suggests that, in view of Nussbaum's opinion, if the origin of testicular teratomas could be traced to these cells, it might furnish a clue to the reasons for their formation. However, although he admits that it is difficult to be certain, he concludes from his observations that they do not arise from the interstitial tissues, but are of intracanalicular origin. This being the case, he considers that there is probably a partial hermaphroditism, and that an ovum is impregnated by a sperm cell of the testis.

This might possibly occur in the majority of the patients, since the tumors usually appear upon puberty; but it is inconceivable in the cases reported by Kockel (three years) and Lovett and Councilman (three months). In these two cases, at least, there can have been no auto-impregnation; and indeed Wilms himself seems to think that the tumors are usually congenital, becoming apparent in later life.

Bonnet (Merkel and Bonnet's *Ergebnisse*, 1899) points out that in cases of hermaphroditism, even in lower vertebrates, ripe sex cells of only one kind are found, those of the other kind, whichever it may be, remaining abortive.

Partial hermaphroditism therefore does not seem sufficient to account for the teratomas.

(4) Parthenogenetic fertilization of an ovum according

to Pfannenstiel and his followers. This might conceivably occur in the ovary of an adult, but would not account for those of congenital origin, nor could it occur in the testis. Since teratomas of the ovary and testis are precisely alike, it is probable that their origin, whatever it may be, is the same, so that a parthenogenetic origin may be ruled out.

(5) The same objections apply to the idea that fertilization of a polar body is the cause of such tumors in the ovary. This theory is based on the known fact that in certain invertebrates one of the polar bodies may become fertilized and develop into a perfect embryo. It seems necessary, therefore, to return to the separated segmentation-cell theory and endeavor to make it account for these growths. It has been shown, as already remarked, that single, dislocated segmentation cells, even up to the sixteen-cell stage of division, may produce perfect embryo; and it may therefore be assumed as probable that any single segmentation cell up to, or almost up to, the point of the formation of the germinal layers possesses the potentiality of producing all of those layers if occasion arises. If, then, such a segmentation cell be detached at the margin of the ovum, it would lie on the surface of those cells which are destined to form the ectoderm and entoderm, and would probably be cast off, though it might accidentally become included at any point where there was an infolding from the surface. Such an infolding occurs along the dorsal surface of the ectoderm to form the medullary canal; and here the cell might become enclosed and form a nucleus for a cephalic or sacral teratoma. Such an infolding occurs also along the entoderm to form the chorda dorsalis, and vertebral teratomas have been reported, although apparently no attempt has been made to decide if they arose in connection with the vertebræ themselves or with the medullary canal. This is a point which it would be difficult, if not impossible, to determine, even if the attempt were made.

If a segmentation cell near the centre of the ovum were detached from its fellows, it would have no chance of escape, but would remain included at a point where the mesoderm

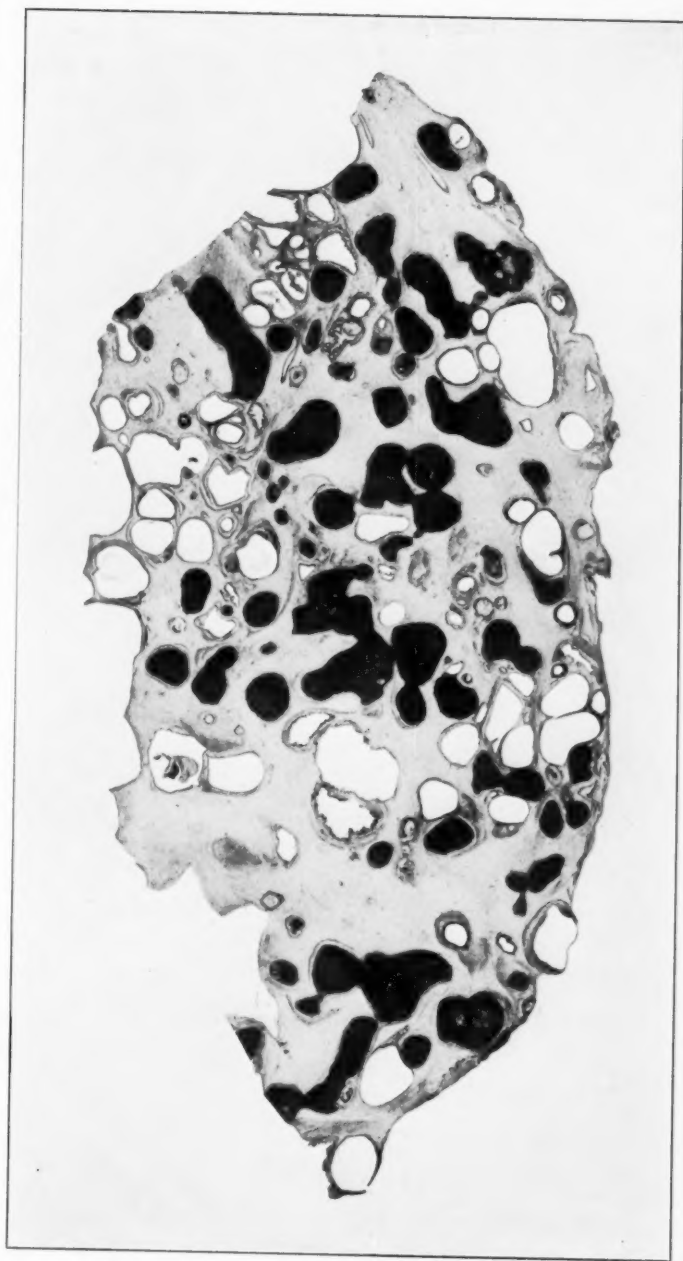
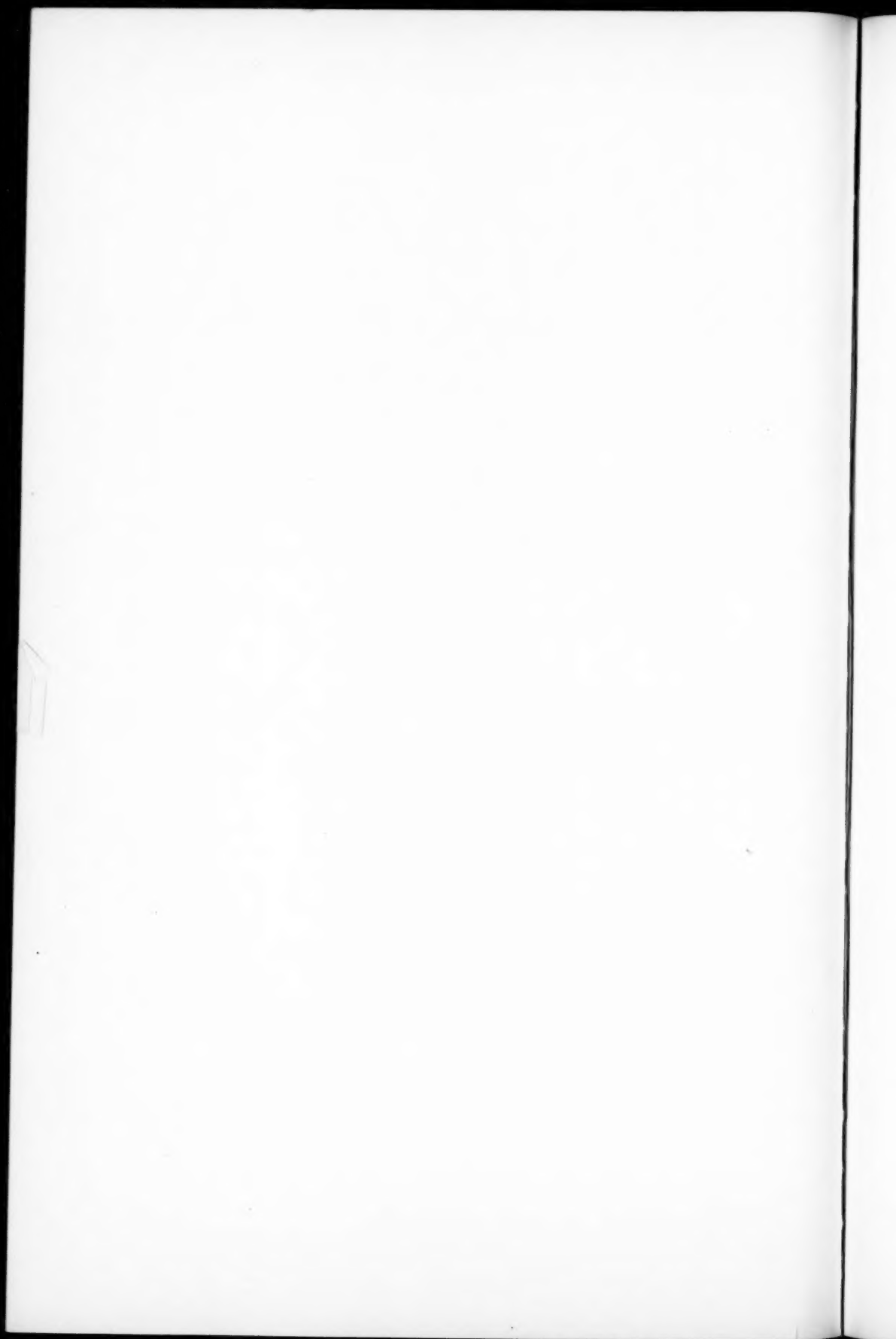


FIG. 3.—Teratoma of testis.



would probably first make its appearance. If such a cell remained entirely surrounded by the normally increasing tissues, it would probably soon become absorbed, but on the formation of the body-cavity might happen to fall into it and there remain alive, gathering strength and the possibility of an independent existence by drawing in the serous exudation for its nourishment. On the formation of the genital ridge the surface epithelium at this point becomes columnar, whereas, over the rest of the body-cavity it flattens out into endothelium. It might be supposed, then, that one segmentation cell would be more likely to become entangled in and enclosed by the columnar epithelium than the flattened, and thus be carried down into the ovary or testis, as the case might be.

SACCULATED ANEURISM OF THE SUPERIOR PROFUNDA HUMERI ARTERY.

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THE following is the history of an aneurism of the superior profunda artery of the left arm in its position in the furrow between the brachialis anticus and the supinator longus muscles, above its point of anastomosis with the radial recurrent artery.

Mr. H. F. McM., aged thirty-seven years, when five years of age, suffered a compound fracture of the elbow; the fracture and wound healed without suppuration, although the arm could not be entirely extended, retaining an angle of about thirty degrees. At fourteen years, he sustained a simple fracture of the upper third of the radius of the same arm; at the age of eighteen, he lost the index and middle fingers of the left hand as the result of the iron rim of a barrel falling upon them; in September, 1899, he sustained a fracture of the wrist of the same arm. Both of the last named fractures healed without any apparent sequelæ.

In July, 1900, he first noticed a small lump, less than a half inch in diameter, at the back of the elbow-joint, and somewhat nearer the internal than the external condyle of the humerus. This he states slowly increased in size, until within about four months it had grown to the size of a horse-chestnut. At this time, which was four months after he first noticed its appearance, he struck the swelling, when it became as large in a few days as his fist, red and painful. Under evaporating lotions it decreased to about the size of a guinea egg; it being about this

size when I saw him in March last, which was nine months after it was first noticed.

At the time of his coming under observation, there was no active inflammation, pain, nor tenderness complained of, either over or about the tumor. Distinct pulsation expansile in character was present, though by no means typical. Examination of the section of the growth readily explains why there was diminished expansile pulsation as well as the distant bruit, the tumor being lined with firm organized clot, which filled more than one-third of the entire circumference of its cavity. Digital compression over the artery on the proximal side of the tumor arrested pulsation, it recurring slowly after pressure was removed.



Aneurism of profunda humeri artery.

There was no difficulty in deciding the character of the tumor; and while there was much reason for the belief that the aneurism might be cured spontaneously, if not, digital compression would surely accomplish the result; yet the growth was in such position that it rendered the arm entirely useless, the elbow could not be rested; it therefore seemed to be a typical case for extirpation.

The tumor was removed by free incision and ligation of the artery on the proximal and distal sides of the growth, which was largely free from adhesions to the underlying soft parts, though it was extensively adherent from the neck well up the body of the tumor to the overlying soft tissues. So far as could be determined, the coats of the artery were perfectly healthy

at the short distance from the tumor that examination of them could be made.

The growth is a typical sacculated aneurism of traumatic origin, involving a vessel that, so far as I am able to ascertain from a rather limited search of the ligature, is unique. The patient has made a perfect recovery.

Fig. 1 shows the location of the growth at the back of the elbow; Fig. 2 illustrates the tumor after its removal with quill passed through either end of the artery; the transverse section of the growth shows the extensively organized blood-clot laminated, imperfectly showing the concentric lines.

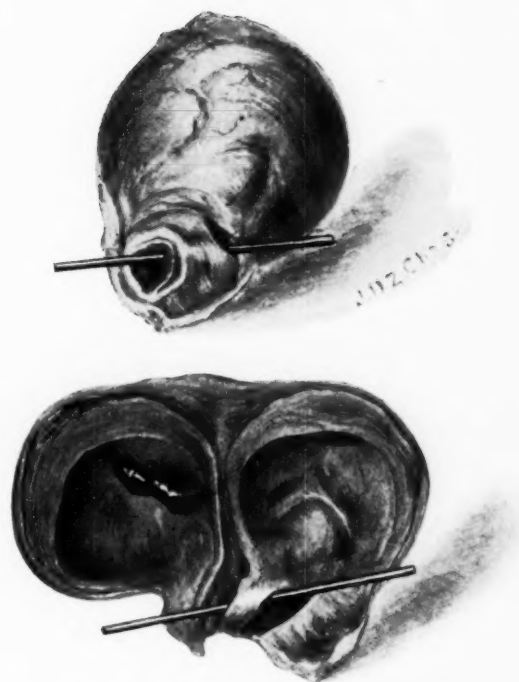
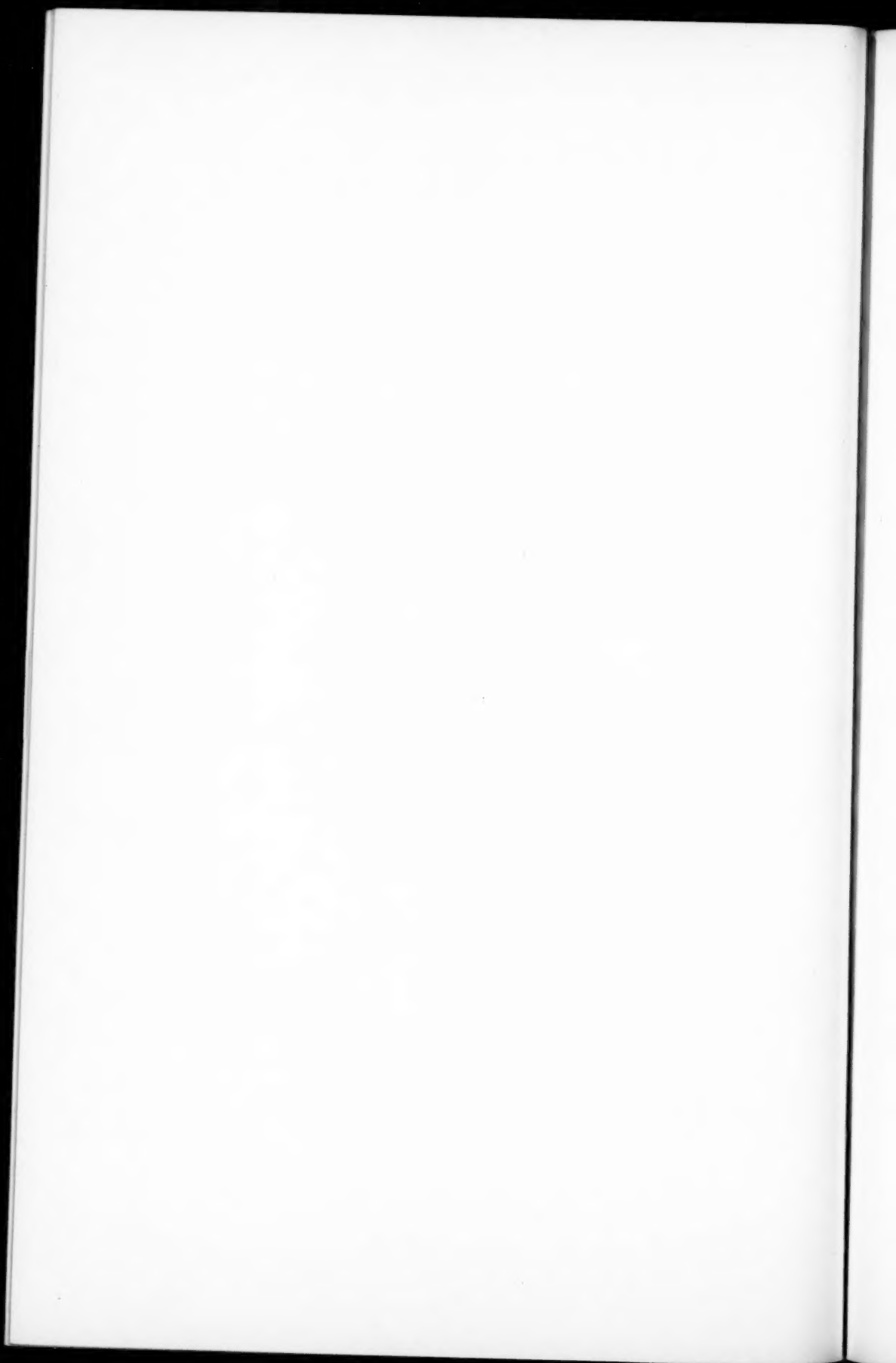


FIG. 2.—Sacculated aneurism of the superior profunda artery.



FRACTURE OF THE SKULL.¹

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THE object in presenting this subject for consideration is to emphasize the importance of early operation in certain cases of fracture of the skull. My views are based upon the experience gained in treating upwards of fifty cases, of almost every variety, from the simple fissured to compound, comminuted, and depressed.

Asepsis and antisepsis have revolutionized brain surgery, and have made recovery possible in many cases that were formerly hopeless. It is well to remember that if symptoms of concussion persist for several days, with no sign of any improvement, it is strongly indicative of injury to the brain proper, perhaps a hæmorrhage, or a fracture of the inner plate.

I recall a case in which the patient was in a condition of apparent concussion, and was treated accordingly; no mark of any kind to indicate injury. No improvement having taken place in four days' time, and his condition having become somewhat worse, I removed a section of the parietal bone, where he was injured. The inner table was found badly broken, and a large collection of blood had formed. The recovery was rapid. In concussion the circulation is feeble, the muscular system is entirely relaxed, and often before improvement occurs vomiting will take place. In the more severe cases contusion of the brain is the evident trouble, and there may be minute hæmorrhages. Where this occurs, and we

¹ Read before the Luzerne County Medical Society, February 20, 1901.

have no history of an injury, we must diagnose between apoplexy, concussion, contusion, and uræmic coma. The difference between the first three is only in the degree of intensity, and may sometimes be decided by some symptoms indicating definite injury to some portion of the brain.

In regard to uræmic coma, the urine of all patients brought into the hospital in an unconscious state, with no history of injury or evidence of same on head, is at once drawn and examined, and this will clear up the suspicion of uræmia, or confirm the diagnosis.

Fractures of the vault differ from those of any other locality; they are usually caused by direct violence, and the fracture, if fissured, may extend to a considerable distance from the point of direct injury.

Usually the inner table is broken over a greater area than the outer, and in apparently slight fractures the dura may be torn by the injury to the inner table. When, however, the condition is due to a gunshot, the point of exit is shown by a shattered outer table. This was well shown in a case I had where a man fired a thirty-eight-calibre ball into his head; it entered at the left side and emerged on the right, the entrance being fairly clean cut; but the exit was shown by an immense gaping wound, the skull being comminuted in a large circle. Depression of the bone is usually due to a hard, quick blow concentrated over a small area, or by a fall on some projection; usually in my own cases it has been caused by a fall of rock or coal, an edge of which has struck and glanced off. If the force be very severe or crushing, the bones may be deeply embedded in the brain. In these cases the inner table is usually greatly comminuted, although the dura may show great resisting power. Should the dura not be torn in depressed fractures, we sometimes have a subdural hæmorrhage, and later compression from clot, if overlooked; but I have observed that after the loose bone has been removed, accumulation beneath the membrane will cause bulging and exaggerated elasticity. Fractures of the anterior part of the cranium frequently involve the orbit; while injuries to the

base are caused by fracture of the middle, anterior, and posterior fossa or radiate from the vault.

In all injuries of the skull, damage to the brain is of first importance. It is not the mere breaking of the cranial bones that is so serious, but the immediate or remote effect on the brain itself; either manifested by hemiplegia, loss of special senses, complete coma, or convulsions. These lesions are further important owing to the fact that the scalp may be uninjured, and these cases require careful consideration and observation of symptoms. While immediate damage may be caused by pressure of bony fragments, later pressure may arise from an injured vessel whose leakage will be manifested by some of the symptoms mentioned above. The question as to which is the most dangerous—pressure from depressed bone, or that from a bleeding vessel—is answered by saying that hæmorrhage is the most dangerous. Where the scalp is torn, examination and diagnosis of fracture, if fissured or depressed, is easy; but in cases of head injury where the scalp is intact, my custom is always to make a free incision under strict asepsis, and expose the cranium, when the fracture can be seen if present. Again, we may examine the skull through our incision and find nothing, yet the patient will show signs of brain injury. In these cases it is best to wait a few hours, and endeavor to restore consciousness by quiet, ice, and mild stimulation. We should avoid drugs that increase the flow or strength of the circulation, for we may be dealing with a cerebral hæmorrhage, and thus add to the trouble. Should no change occur after some hours and symptoms gradually increase in gravity, we should at once trephine and endeavor to find the cause, and remove it if possible.

In one case a man was struck on the head by a piece of coal. No evidence of injury to the brain was present, and he was treated expectantly; the third day after injury he began to show signs of stupor, which soon progressed to unconsciousness. I opened the skull over the meningeal artery and found a large clot; this was removed by irrigation and careful separation, and the wound packed with sterile gauze, as the bleeding

was rather free. The patient recovered rapidly, and left the hospital well.

In cases of immediate hæmorrhage producing unconsciousness, the injury is usually one of severe depression and comminution of bone, or perhaps a deep impaction may be the cause, with little bleeding; and on removing the depressed and impacted bone recovery may be rapid. Operation alone will determine the source of hæmorrhage, whether from the meningeal or its branches, or from pial veins, or from a sinus. Hæmorrhage from a sinus, such as the superior longitudinal, is usually not hard to control.

I have had three cases in which hæmorrhage from this sinus was pronounced, and in each case packing served to check it; one case required several changes before being successful. In another case, in which the temporal bone was badly fractured, a small vessel in the mastoid portion, leading to the lateral sinus, gave much trouble by persistent bleeding; this was controlled by enlarging the opening and packing firmly. The only unfortunate result in this case was deafness, otherwise a complete recovery from a bad fracture.

The kind of fracture present will often help to determine the probable injury to the brain. A depressed or comminuted fracture will suggest some injury to the brain beneath. It is well known that fatal results have occurred from injury to the longitudinal sinus from a severe blow over the skull; again, a linear fracture may injure one of the branches of the meningeal. I have, on the other hand, seen a very severe depression and comminution of the frontal bone, with involvement of the orbit, and no symptoms of severity developed at any time, and aside from the scar left after operation and sense of fulness when stooping, the patient was apparently as well as ever. In considering *fractures of the base*, we have a class that is far more serious than those mentioned. The injury to the cranial contents is greater, and is often in some vital centre, while the nature of the protecting wall requires often greater force or violence to produce the injury. Again, these fractures may and do extend into parts that are hard to reach, and equally

hard to clean or drain, and infection is apt to occur, resulting in a fatal termination. Many fractures of the base (so called) get well, and without any interference. Eighty-five per cent. of basic fractures originate in the vault, and are caused by an extension of a linear fracture of the vault to the base (according to Scudder).

I have seen at least three cases where the injury was received upon the parietal bone, the fracture ending in the mastoid portion of the temporal. The symptoms are usually well marked, such as hæmorrhage from the ear, mouth, nose, and also the eyes; cerebrospinal fluid may escape from these channels, or from the wound itself, as in a case I had where a man was struck back of the ear with a sharp axe, which penetrated squamous and mastoid portions of the temporal, and entered the brain; hæmorrhage was profuse, and cerebral fluid as well as particles of brain were discharged. The wound was enlarged, irrigated, and packed; recovery uneventful, except that deafness was present when the man was discharged. In regard to treatment, when possible, fractures of the base, especially of the middle and anterior fossa (if shown by hæmorrhage into the subconjunctiva), should be treated by drainage; and where the fracture is marked and external the bone may be carefully elevated and removed, if indicated, under strict aseptic precautions. In regard to the technique of the operation, we must remember that scrupulous cleanliness must precede any operative work of this character; the scalp must be made as aseptic as possible. In most of my cases, where the hair, and often the wound, and even the periosteum is filled with coal dirt, it has been no easy task to secure asepsis.

In speaking of trephining, I mean the use of chisels and mallet or elevator and rongeurs; the actual trephine being seldom used.

To summarize this subject, I would say, the general treatment of fracture of the skull, whether compound, depressed, or comminuted, should be by operation. In all simple fractures where the slightest indication of intracranial pressure or hæmorrhage is present, operate. Even simple fractures followed

by no symptoms need watching, and especial care given to the general system. The prognosis in fractured skull is to be guarded, and to be guided by subsequent developments. A subnormal temperature followed by a rapid rise is a bad indication. Coma, paralysis, deep, irregular breathing, and dilation of the pupil are nearly always of fatal significance. A temperature at or above normal, rising one or two degrees, with regular respiration, and full or slightly accelerated pulse is usually favorable.

RECORD OF CASES OF FRACTURED SKULL OPERATED UPON.

No. 1.—L. F., aged thirty-two years, Austrian. Struck on head by fall of rock. Examination showed compound depressed fracture of parietal and frontal bones. Unconscious. Operation performed soon after admission. Recovery.

No. 2.—M. C., aged thirty years, Hungarian. Injured by blast in mines; brought to hospital. Examination showed fracture of frontal bone. Operation immediately performed. Fracture included the upper part of orbit; all fragments removed. Recovery.

No. 3.—M. H., aged twenty-two years, Polander. Struck by falling coal; brought to the hospital, where examination showed compound depressed fracture of parietal bone. Patient partly conscious, but completely paralyzed on side opposite injury; speech entirely gone. Operation showed meningeal rupture and severe destruction of bony structures. Recovery.

No. 4.—G. D., aged nineteen years, Hungarian. Caught by fall of rock while at work; brought to the hospital. Examination showed depressed fracture of vault. Unconscious. Operation immediately performed. Recovery.

No. 5.—A. H., aged forty-five years, Hungarian. While waiting for a blast to occur, and thinking the fuse had gone out, he went to examine same, when the charge of dynamite exploded. He was brought to the hospital, where the examination showed much laceration of the entire chest and arms, while his head was hardly human in appearance. The skull was badly crushed, and both eyes bulging out. Operation performed as soon as he could be gotten ready. A large part of the frontal bone was removed, together with part of the orbit. Portion of protruding brain cut

away, both eyes enucleated. Wounds about body sutured, and the man put to bed in a most critical condition. For five days he was a maniac, and required constant watching as well as handcuffs. He then began to improve, and made a rapid and perfect recovery. An object of pity and a charge on his friends, but a triumph for antiseptics.

No. 6.—J. F., aged twenty-one years, German. Shot with small rifle, carrying twenty-two-calibre ball. The missile entered just above the right eye; brought to hospital at once. Examination showed small wound in skin, but on enlarging same, the frontal bone was found not only penetrated, but also cracked in a fairly wide circle. The skull was trephined and all spiculæ removed. Irrigation was thoroughly but cautiously done. The search for the bullet was abandoned, when a fine probe entered some three and one-half inches by its own weight. Drainage was established. Patient put to bed. Paralysis of left arm and leg was marked. Recovery was slow, but he was finally able to use his limbs and resume work.

No. 7.—D. E., aged fifty-four years, Welshman. Struck with a hatchet (the sharp edge) over the temporal region; brought to the hospital, where examination showed that the blade had penetrated the mastoid cells below; the entire temporal bone was cut through. Hæmorrhage severe, both from the wound and from the ear. Operation performed at once. Loose bone removed, mastoid portion enlarged, and thoroughly cleansed. Wound was packed to control hæmorrhage. Recovery.

No. 8.—S. M., aged thirty years, Polander. Struck by piece of flying coal; brought to hospital unconscious. Examination showed large depressed fracture of frontal bone. Operation at once. Depressed bone elevated, part of orbit removed. Recovery.

No. 9.—G. P., aged twelve years, American. Fell about twenty feet while at work on breaker; brought to hospital. Unconscious. No evidence of fracture. Slight abrasion of left side of head. Condition remaining unchanged after a few hours, the boy was prepared for operation. Incision over parietal bone, and removing periosteum, showed a very small fissure, but on trephining over same, a clot from meningeal was found. This was removed, and the wound irrigated. Drainage established. Recovery rapid.

No. 10.—R. K., aged thirty years, Italian. Struck on head by fall of rock; brought to hospital. Examination showed a compound and comminuted fracture of frontal bone and orbit. Operation at once performed. Fragments removed, drainage induced. Patient made an excellent recovery.

No. 11.—D. M., aged thirty-two years, Scotchman. Was struck by runaway car in mines; brought to hospital, where examination showed compound comminuted and depressed fracture of the vault; compound fracture of nasal bones, compound fracture both superior maxilla and inferior maxilla, and destruction of right eye. The fragments were removed, eye was enucleated, jaws placed in apposition. Thorough drainage established, and patient put to bed. He regained consciousness and spoke rationally for three days, when death occurred suddenly. Superior longitudinal sinus injured. Bleeding checked by sterile gauze packing.

No. 12.—J. McH., aged twelve years, American. While playing shinny he fell, breaking the stick, and his head struck the sharp end of the other part, which was driven through the eye and orbital plate into the brain. Was not considered at all serious until several days later, when he became unconscious, and developed a high fever. He was then brought to the hospital, and from his symptoms and history I diagnosed an abscess of brain, due to infection. Prognosis, probably fatal. Operation showed great destruction of orbit, also eye, and severe injury to brain, which discharged pus freely when the opening was enlarged. He reacted well from operation, but died in two days. This case might have recovered if brought to hospital when first injured.

No. 13.—A. G., aged twenty-five years, Hungarian. Caught by fall of coal; brought to hospital, where examination showed a large compound depressed fracture of the vault. Condition was critical. Patient stimulated (hypodermically) and prepared for operation. Several pieces removed from parietal bone, and one piece from frontal; depressed portion elevated, and left alone. Drainage established. Recovery.

No. 14.—J. W., aged sixty years, Irish. Struck by flying rock from blast; brought to hospital. Examination showed compound depressed fracture of parietal bone. Paralysis complete on left side of body, also loss of speech. Stupor, from which he could be temporarily aroused. Operation showed extensive frac-

ture and rupture of the meningeal artery. Fragments removed; depressed portion elevated; bleeding checked. Patient regained speech and motion, but succumbed to the injury after ten days, the deeper portion of brain being undoubtedly injured.

No. 15.—S. M., aged thirty-five years, Hungarian. Struck by locomotive; brought to hospital. Examination showed compound depressed fracture of the vault. Patient unconscious, and severely shocked. Operation performed two hours after admission. Part of parietal bone removed; depressed frontal bone elevated, clot beneath dura turned out, brain irrigated, dura sutured, drainage established. Recovery rapid and complete.

No. 16.—J. K., aged twenty-seven years, Austrian. Injured by premature blast. Examination showed extensive lacerations of scalp and face, and a large depressed fracture of the frontal bone. Operation immediately performed. Recovery.

No. 17.—H. H., aged forty years, American. Fell a distance of forty feet from a building in course of erection, and struck different floors in his descent. Brought to hospital with fracture of frontal and nasal bones, fracture of superior maxilla (both bones), dislocation of left shoulder, and lacerations of back and scalp. Operation performed; shoulder reduced. Recovery complete.

No. 18.—F. B., aged forty-two years, Austrian. Injured by blast at stripping; brought to hospital with severe fracture of vault, dislocated shoulder, and contused back. Operation; removal of part of frontal and parietal bones. Dislocation reduced. Recovery.

No. 19.—G. P., aged forty-nine years, Italian. Caught by fall of coal. Examination at hospital showed fracture of frontal bone and lacerations of scalp. Operation. Recovery.

No. 20.—C. F., aged twenty-one years. Was assaulted by comrade, and said to have been struck by a cobble-stone. Brought to hospital thirty-six hours after injury. Examination showed very severe compound depressed fracture of the frontal and parietal region. Operation; removal of fragments, elevation of depressed bone, removal of part of orbit. Recovery.

No. 21.—J. B., aged fifty years, Austrian. Struck on head by fall of coal. Examination showed compound depressed fracture of frontal bone. Operation. Recovery.

No. 22.—J. G., aged seven years, American. Fell from third

story of house to hall below; brought to hospital eighteen hours after the injury. Unconscious. Examination showed entire vault of skull crushed, and base undoubtedly fractured. Operation palliative; lived thirty-six hours.

No. 23.—S. L., aged twenty-eight years, Polander. Injured by blast. Examination showed depressed fracture of parietal and occipital bones. Operation showed laceration of brain. Death.

No. 24.—P. S., aged forty-two years, Hungarian. Injured by fall of rock. Examination showed extensive laceration of scalp, and compound depressed fracture of parietal and frontal bones. Operation performed; depressed bone elevated, fragments removed. Drainage established. Superior longitudinal sinus wounded, controlled by packing. Recovery.

No. 25.—C. C., aged fifty-three years, Irish. Caught by fall of coal. Examination showed fracture of parietal bone, and also of two ribs. Operation performed. Recovery.

No. 26.—W. S., aged twenty-six years, Hungarian. Injured by fall of rock. Examination showed compound comminuted and depressed fracture of vault. Operation; removal of fragments, elevation of depressed bone. Drainage. Death in four days by collapse.

No. 27.—C. S., aged twenty-four years, American. This case is one of special interest, and will be reported more fully than others. The patient was accustomed to going in a saw-mill each morning to inspect the machinery and oil up various parts. One of the saws was what is called an "overhead" or "belt" saw. The morning of the accident the patient walked into the room to attend to his duties, and without a thought walked directly against the overhead belt saw. Instantly he was senseless and bleeding. Physicians were summoned, and the unconscious man was rapidly transferred to a special engine, and sent on to the hospital, ten miles from the scene of the accident. On his arrival the features were almost unrecognizable. The saw had made a clean division from the parietal eminence to his chin. The nose was in two complete halves, and the posterior nares lay open in plain view. His pulse was fair, considering the shock and hæmorrhage, although the bleeding was not so severe owing to the lacerating and tearing of the saw, which acted as a sort of hæmodynamic. A portion of the frontal lobe of the brain was protruding, while the parietal region was invaded also, but not as deeply. I

cut away all the lacerated frontal tissue; trimmed the torn dura back to the parietal eminence; chiselled away the jagged bone; removed part of the frontal bone and part of the parietal; removed some of the nasal fragments; brought the nose together with heavy sutures; irrigated the brain with salt solution; established thorough drainage, and finally put the man to bed, as I thought, to die. His temperature, however, never went over 100° F., and he made a rapid and complete recovery, with no mental symptoms of any kind, and, aside from the extensive scar and the hollow where the bone was removed, he is as well as ever, and works every day. The superior longitudinal sinus was torn and hæmorrhage from it was free; this was controlled by packing with sterile gauze.

No. 28.—D. B., aged fifty-five years, Irish. Injured by fall of rock. Examination showed fracture of frontal bone and laceration of eye. Operation. Recovery.

No. 29.—H. S., aged twenty years, American. Fell backward off a trolley-car; brought to hospital. Examination showed severe hæmorrhage from ear and nose; no mark on scalp beyond slight swelling over temporal region. Diagnosis, fracture of middle fossa. Operation, incision from mastoid portion, curved upward to parietal; long fissured fracture extending across temporal bone; section of bone removed, considerable blood-clot beneath dura, which was opened and drained. Recovery was rapid; patient somewhat deaf.

No. 30.—A. M., aged sixteen years, German. Was struck on head by a piece of coal weighing about fifty pounds; brought to hospital. Examination showed entire parietal and part of frontal crushed in. Operation showed rupture of middle meningeal and laceration of brain. Patient lived three days.

No. 31.—J. McD., aged fifteen years, American. Engaged in quarrel with another boy, who struck him with a rock on the side of his head. Brought to hospital with fracture of the parietal bone. Operation showed severe depression of same, with involvement of meningeal artery. Fragments removed, clots cleared away, and drainage established. Recovery.

No. 32.—G. M., aged twenty years, Hungarian. Caught by fall of rock while at work. Examination showed compound depressed fracture of parietal bone. Operation performed. Recovery.

No. 33.—P. G., aged twenty-two years, Hungarian. Caught by a fall of coal while at work. Examination showed compound depressed fracture of left parietal bone. Paralysis complete of right arm and leg; absolute loss of speech; otherwise conscious. Operation; found comminution and depression of parietal and temporal bones; removed fragments and elevated the depression; part removed was about the size of a silver dollar. Hæmorrhage was severe from the meningeal, which was injured. This was controlled by packing sterile gauze about the bleeding point; drainage was established. Patient moved limbs in thirty-six hours, but speech did not return for nearly one week, indicating a slight hæmorrhage in the deeper centres. Final result complete recovery.

No. 34.—A. W., aged thirty-four years, Polander. This man had a history of epileptic fits for five years previous to admission. These fits occurred at regular intervals, but he worked in the mines until the latter part of October. He then had spells of unconsciousness, followed by chills and rise of temperature. On election day he spoke to his brother and his physician, then became paralyzed in his right arm and leg, and lost his speech. This continuing for nearly three weeks, he was brought to the hospital for treatment. His temperature and general appearance indicated pus, and the diagnosis of abscess of the brain was made, situated in the parietal lobe. Operation was performed November 22, and as soon as the dura was reached its bulging indicated fluid beneath, and on opening same a large quantity of pus gushed forth. The abscess cavity was very large, and had evidently been progressing for a long time.

The cavity was thoroughly irrigated and drainage introduced. Temperature fell to normal in eight hours, and the next morning, twenty-four hours later, he spoke plainly, and could raise both arm and leg. This improvement continued for four days, when he suddenly collapsed and died. I should also say that he had been trephined some seven years ago.

No. 35.—G. M., aged twenty-one years, American. Struck during an altercation on back of head with a water-soaked club, six feet long; brought to hospital. Examination showed profuse and steady bleeding from right ear and nose, indicating fracture of middle fossa and probably in temporal bone. Patient deeply insensible. An incision showed a large depressed fracture of the

temporal bone, the mastoid portion being severely depressed, and the fissure extending up into the parietal bone. All loose fragments were removed and depressed portions elevated. Drainage established. Bleeding from ear ceased in a few hours. Consciousness returned, and recovery was rapid. Some deafness in right ear.

The details of ten additional cases of fracture are omitted, as they were hopeless and not operated on; all died in a very few hours after admission.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, March 27, 1901.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

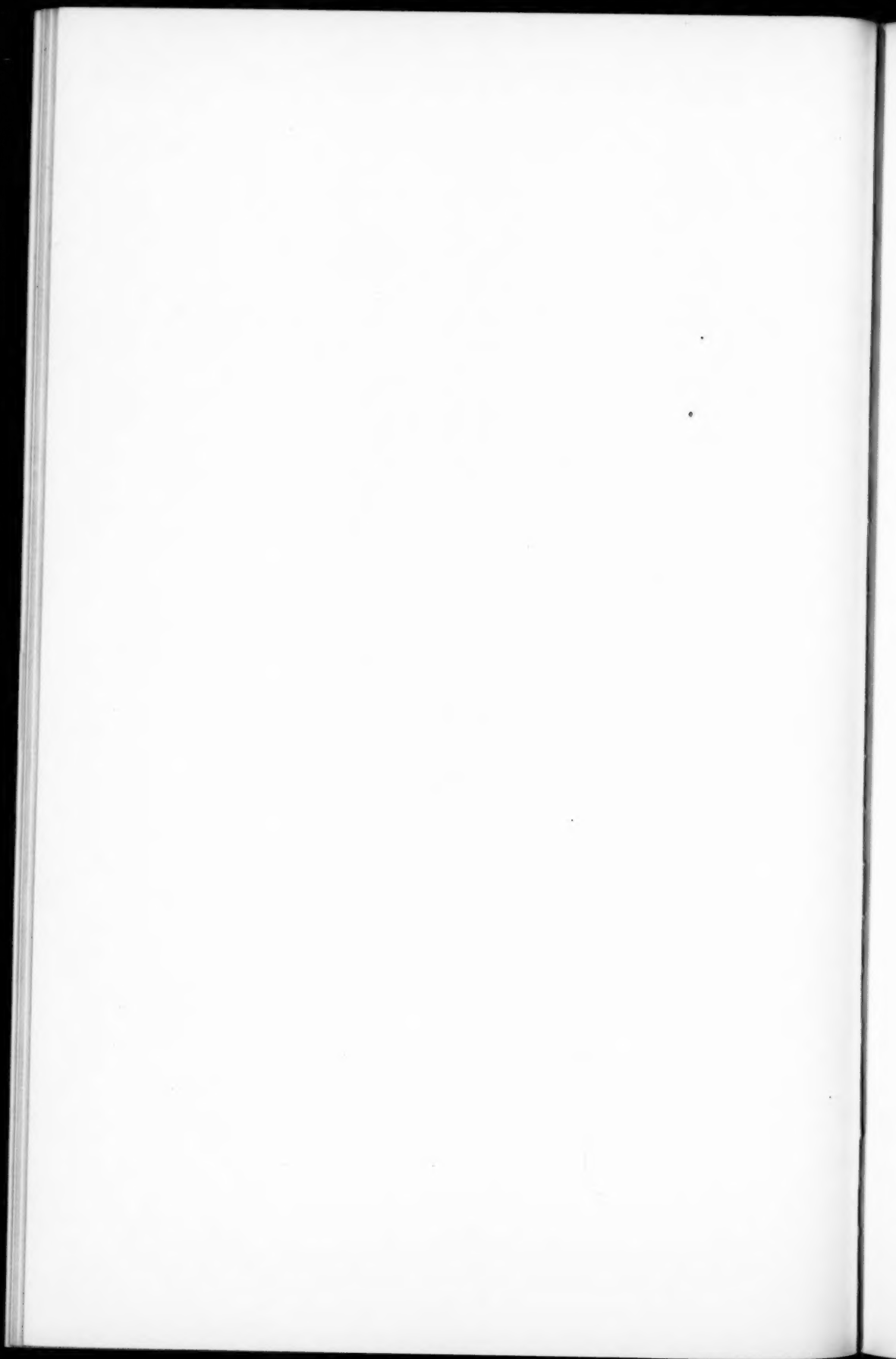
CIRSOID ANEURISM SUCCESSFULLY TREATED BY EXCISION AFTER LIGATION OF THE EXTERNAL CAROTID.

DR. WILLIAM B. COLEY presented a woman, aged thirty years, who nineteen years ago fell from a car, striking her face on the pavement. Soon a small vascular swelling developed in the region of the injury. This increased very slowly, until eight years ago, when it began to grow more rapidly. The growth increased more markedly after the birth of every child. About five years ago she noticed a distinct bruit, that has increased ever since and has been very annoying.

Physical examination, January 30, 1901, showed a pulsating tumor occupying the entire right temporo-orbital and upper facial region, about five inches in diameter. (See Fig.) The tumor showed marked pulsation, and the bruit was so distinct that it could be heard with the ear some distance from the tumor. No treatment of cirsoid aneurism in this region, up to the present time, has been regarded as very satisfactory, and various authors differ widely as to the best method. Lidell (Ashhurst's "Encyclopædia") states that of seventy-three cases of ligation of the common carotid the mortality was 30 per cent., and only 50 per cent. of the surviving cases were cured. Mussey's case is cited as having been improved only after a second ligation of the carotid, and finally cured by excision. The operation was very bloody; the vessels were tied one by one, and it is stated as many as twenty ligatures were applied. The operation of excision had been done by about a dozen surgeons at the time of Lidell's paper.



Cirroid aneurism.



In the case under consideration, Dr. Coley proceeded as follows: Under ether anæsthesia, he first put a double ligature of kangaroo tendon upon the right external carotid artery, and then made a longitudinal incision over the centre of the tumor, about four inches in length. The aneurismal tumor was then exposed by dissecting off the skin flaps on either side of the incision, and, beginning at the lower border, the tumor was dissected out, the large vessels being clamped and ligatured one by one before cutting; some of the vessels were of very large calibre, some of them one-eighth inch in diameter. Although the pulsation of the tumor was stopped by the ligature of the carotid, the blood supply of the tumor remained considerable, and it would have undoubtedly been impossible to control the hæmorrhage, had not the carotid been first tied. Nearly a hundred ligatures were applied, and the wound was closed with silk and silkworm-gut sutures, being drained with gauze from the lower extremity, and firm pressure was applied by means of gauze pads and bandages. The wound healed by primary union, except at the point of drainage; up to the present time the result has been extremely satisfactory.

DR. WILLY MEYER said that about six years ago he showed before the Surgical Society a case of cirroid aneurism in the right temporal and scalp region which he had operated on in exactly the same manner as that pursued by Dr. Coley. After tying the external carotid he made a large incision over the aneurism, and then excised it step by step. This, of course, necessitated the ligation of many large vessels. Preliminary ligation of the external carotid and excision of the aneurism at the same sitting, Dr. Meyer said, was the only proper method of treating these growths, in his opinion. If the tumor be very large, involving both sides of the face and scalp, it may be necessary to ligate both external carotids.

TERATOMA OF THE TESTIS.

DR. COLEY presented a patient from whom he had removed a tumor of the testis, and read an account of the case, with critical remarks, for which see page 391

DR. LILIENTHAL said that in dealing with a doubtful tumor affecting an organ like the testis, which can easily be spared, it is perhaps better to make the diagnosis after the removal of the

growth. Without entering into the refinements of pathology, we do know that tumors of the nature of teratomata have at times proved to be malignant, and it is best to regard them as such and treat the case accordingly.

DR. B. F. CURTIS called attention to the fact that the result of a pathological examination of sections taken before operation is often very misleading. In a case of his own, a palatal growth, which was pronounced sarcoma by the pathologist, proved to be a congenital tumor, the clinical diagnosis having been correct.

UNUNITED FRACTURE OF THE FOREARM.

DR. F. TILDEN BROWN presented a case of ununited fracture of the forearm, for the double purpose of exhibiting the remarkable ranges of usefulness of such an extremity when supported by a light metallic ferrule brace, and at the same time to seek an expression of opinion as to the proper step to pursue, now that the broken extremities are becoming more and more displaced, painful, and threatening a return of disability of the hand and arm.

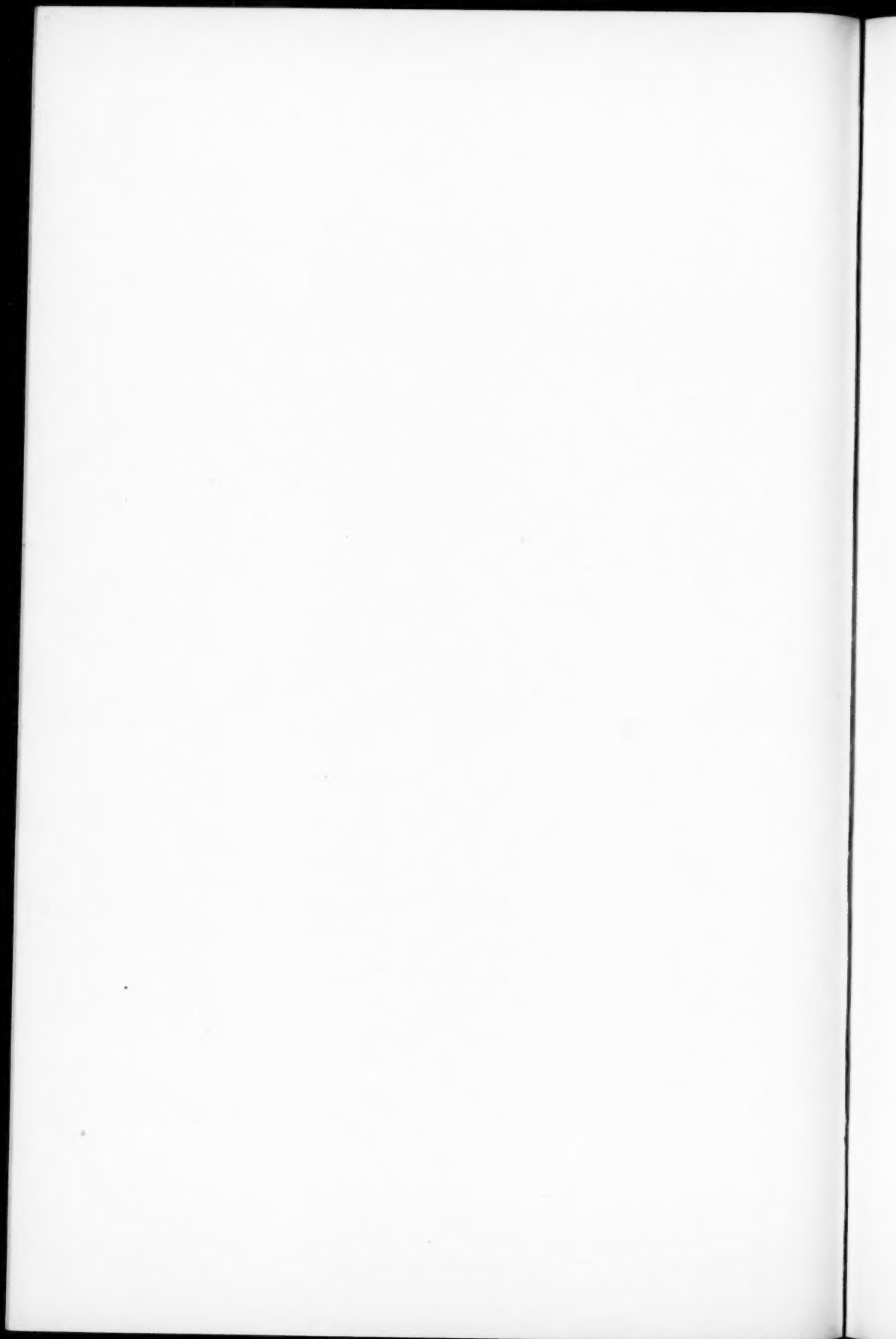
On November 4, 1898, the patient sustained a compound fracture of the right forearm. He was treated in an uptown hospital for about three months; there was then promise of union, but a decided angular deformity outward and backward and great disability in rotation. He then applied at another hospital, where on February 28, 1899, both bones of the forearm were cut down upon by separate incisions, the angular deformity and intervening callus excised, and after apposition the periosteum was brought together by catgut sutures, slight fibrous union of the ulna following.

Six months later, on August 25, 1899, the patient came under the care of Dr. Brown. Now the chief features were a faint, slight fibrous union, pain at site of the radial cicatrix. No rotation, and but slight movement in the contracted fingers. On taking a radiograph, there was visible a key-like extension of callus from the lower half of the ulna, which seemed in several ways to threaten permanent disability. The patient was eager to have something more done.

On August 31, 1899, an osteotomy of both extremities of both bones through a single longitudinal dorsal incision was made, bringing the ends in apposition with heavy chromicized catgut.



FIG. 1.—G. S., August 25, 1899, ten months after fracture and six months after the first excision.



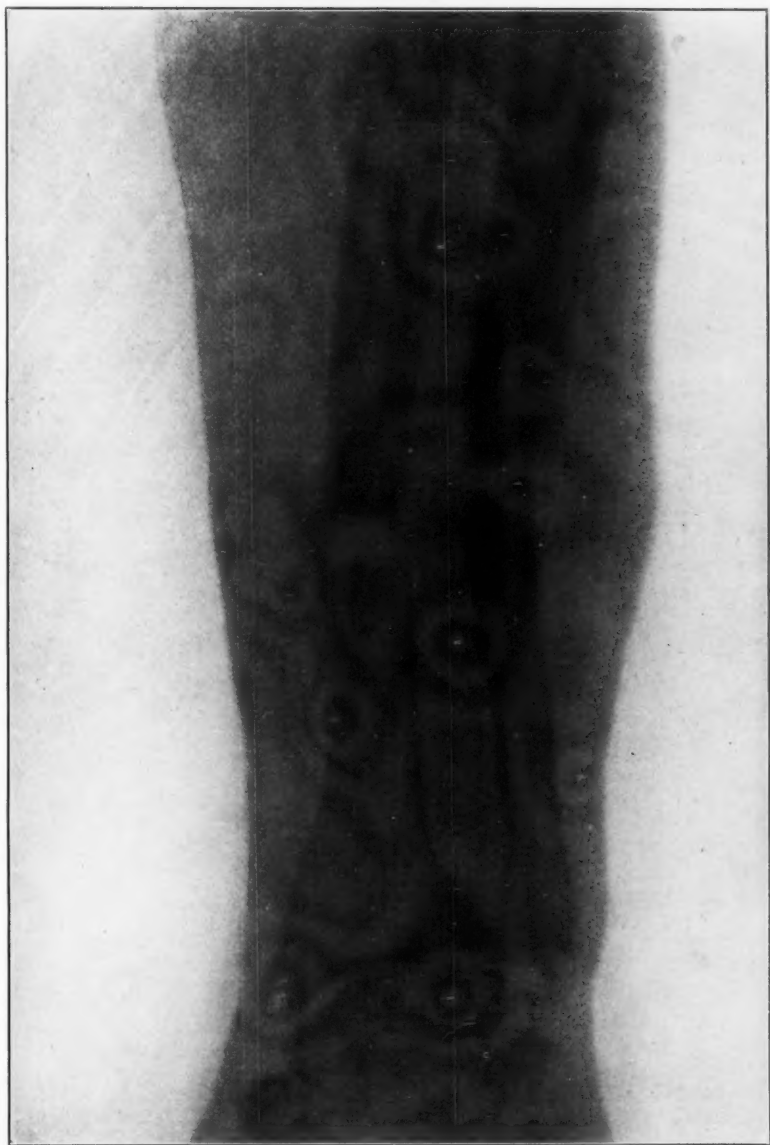


FIG. 2.—G. S., September 27, 1899, twenty-seven days after the second excision. Promising amount of callus between ends of the radius.



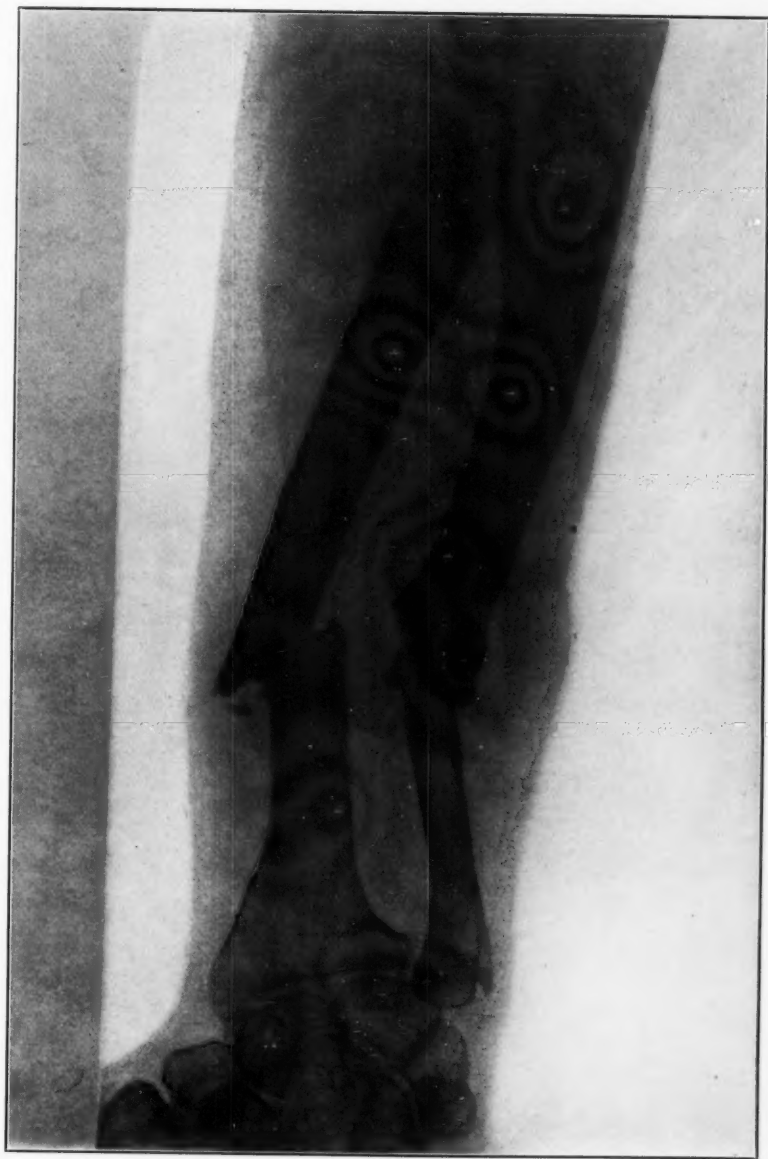
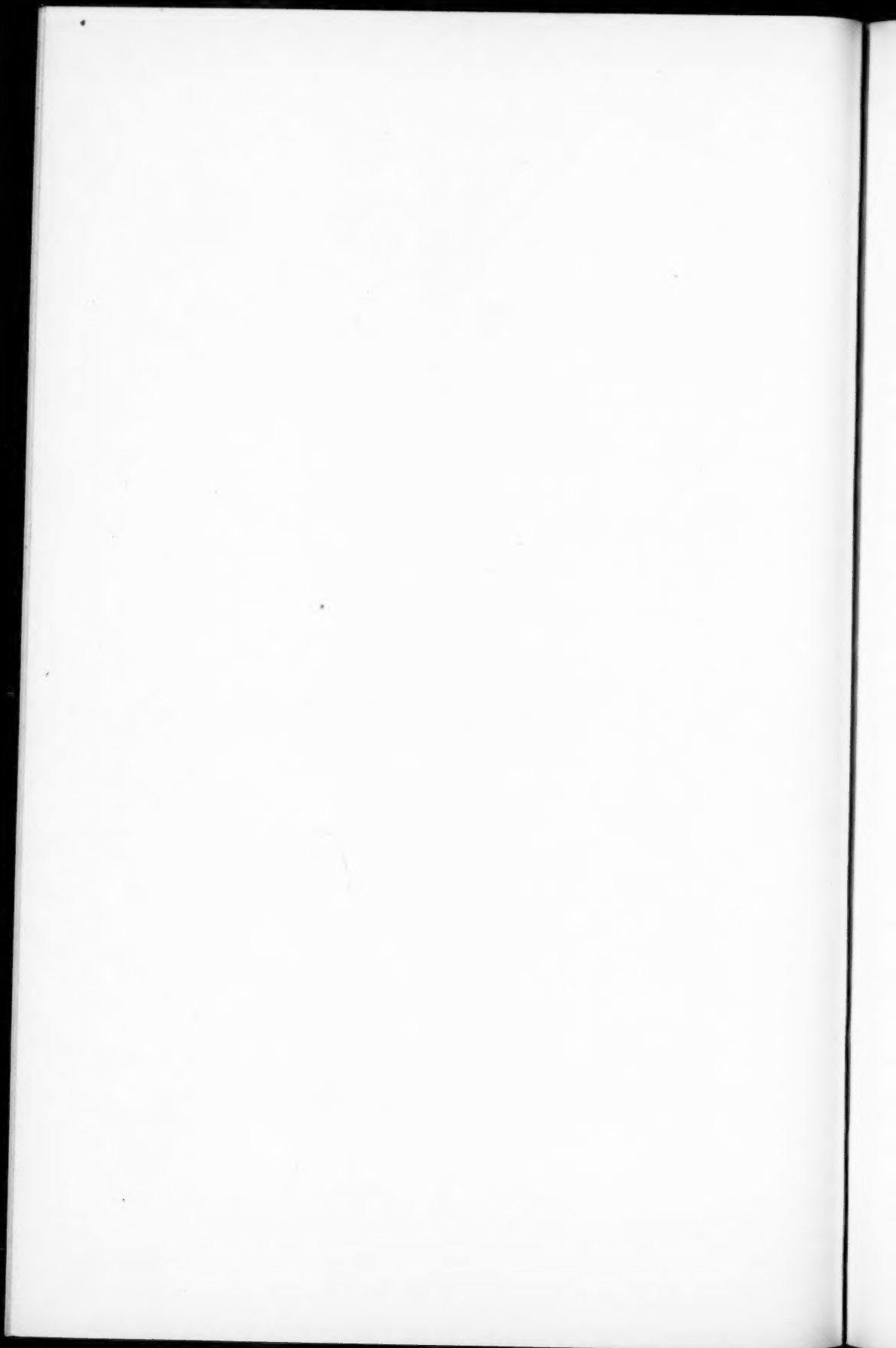


FIG. 3.—G. S., February, 1901; present condition.



The cutaneous wound healed primarily. Care was exercised with the splints and an interosseous pad, as the tendency for the bones to lose their parallelism had been noted.

About one month later the second radiograph showed a promising state. A slight bridge of union is seen between the ends of the radius; none, however, on the part of the ulna. He had already acquired considerable mobility of the fingers, and the extreme tenderness at seat of former radial incision had disappeared. Shortly after this a personal illness prevented Dr. Brown seeing the patient for some six months. Then the former promise of union had disappeared; the position of the bones was again quite faulty, but with the plaster splint on he could and had been using the hand and arm for light work. The man was willing to have another attempt made to secure union by operation, but the attendant uncertainties both immediate and remote induced Dr. Brown to advise that he try to get along with an adjustable leather steel splint. Dr. W. R. Townsend very kindly equipped him with such a device, by means of which he was able for some time to ill advisedly do such heavy work as using a shovel and pick-axe; but latterly he has been employed in tying up and sorting heavy packages of periodicals. Increasing deformity and pain in the arm have gradually returned. A month ago a third radiograph was made, which shows atrophy of the distal ends of both bones.

DR. LILIENTHAL asked Dr. Brown whether he had tried the effects of internal medication in the form of thyroid extract. The speaker said he had resorted to it in one case with apparently good results. The patient was a woman with a fracture of the arm which failed to heal after two operations. She would not submit to further operative measures, and was accordingly fitted with a splint something like the one worn by Dr. Brown's patient; and in addition to this she was put upon thyroid extract for about a month. She was then lost sight of for two years, and when Dr. Lilienthal saw her again, perfect union had taken place. The woman dated her improvement from the time that she took the thyroid extract.

DR. IRVING S. HAYNES reported the case of a man, forty-five years old, who had fracture of eighteen months' standing which had failed to unite by the ordinary methods of treatment. Five operations were necessary before union was obtained. The first

attempt consisted in breaking up the adhesions and friction of the fragments. They failed to unite, and a section of the fractured ends was removed. This had to be repeated again, and this time the ends were wired, but without success. At the fourth operation a little more of the bone was removed and the ends were united with silk, but again the operation proved unsuccessful. At the fifth operation the ends of the bones were bevelled off for an inch and spliced together by means of wires passed around each side of the fragments. After this operation there was perfect union. The total shortening in the limb was two and seven-eighths inches, and pronation and supination were two-thirds of the normal. The functional result was practically perfect. The man was able to resume his work as a day laborer, wheeling a loaded barrow which probably weighed 200 pounds.

DR. BROWN said the only internal medication he had resorted to was in the shape of tonics, as the man's general health was rather poor. The use of thyroid extract had occurred to him, but the reports regarding its use in these cases have not been very encouraging. The speaker said he was glad to hear the report of Dr. Haynes's case and its successful outcome after the fifth trial, and he was inclined to resort to another operation in the case he had shown.

PYLORECTOMY FOR CARCINOMA: NO SIGNS OF RECURRENCE AFTER EIGHTEEN MONTHS.

DR. B. F. CURTIS presented a man, thirty-five years old, upon whom he had done a pylorectomy for carcinoma of the stomach on August 5, 1899. The patient made an uneventful recovery from the operation and is apparently in excellent health at present. Subsequent to the operation, his weight increased from 108 to 180 pounds, and he now weighs about 170 pounds.

Dr. Curtis said the history of this case was published in full in *Yale Medical Journal*, January, 1900. The patient gave a history of stomach trouble dating back five years, and an operation was done under the supposition that the case was one of benign growth of the stomach. It proved, however, to be one of chronic carcinoma. A large tumor was found which had evidently formed on the base of a chronic ulcer, and there was great thickening of the stomach wall underneath. The stomach was much dilated, the patient sometimes vomiting a gallon of its contents. The opera-

tion was done by Kocher's method, cutting across the organ, suturing it, and then uniting the duodenum to the stomach at another point with a Murphy button.

Dr. Curtis said that a day or two ago he saw another patient upon whom he performed pylorotomy on the 28th of October, 1889. (See *ANNALS OF SURGERY*, 1900, xxxi, p. 758.) The patient was a woman of very large frame, weighing at the time of operation only 120 pounds. She now weighs 225 pounds and remains well to a certain degree. She has long been addicted to the excessive use of alcohol, and complains of moderate vomiting, which is not "obstructive" and appears to be due to an alcoholic gastritis.

MULTIPLE BIRDSHOT WOUNDS.

Dr. PERCY R. BOLTON presented a boy, aged thirteen years, who was brought into the Hudson Street Hospital with the history of having been fired on with a shot-gun loaded with No. 4 shot from a distance of between twenty and thirty feet. By actual count, the boy had 110 little shot wounds distributed from the level of the jaw to the knee over the right side of the body.

The thoracic wall was penetrated and the right lung injured, as evidenced by collapse of the lung, hæmothorax, emphysema of the chest wall, and hæmoptysis.

The abdominal wall was probably penetrated, for there were distention, rigidity, and tenderness over the right side of the abdomen, together with much higher temperature and greater rapidity of pulse than usually follows penetrating wounds of the chest.

No attempt was made, however, at operative interference for the abdominal and possibly intestinal lesions, owing to their probable multiplicity and to the associated thoracic injuries. After about a week, during which the patient's general condition seemed almost hopeless, the symptoms waned and recovery followed.

NEPHRECTOMY.

Dr. F. KAMMERER presented a man, about forty years old, who came under his observation three years ago with the history of inflammatory renal affection. Upon examination, a tumor in the region of the left kidney was readily made out. The urine contained some pus, and the case was regarded as one of renal calculus which had led to degeneration of the left kidney.

Upon laying open this organ, it was found to be in a state of cystic degeneration. It was about three or four times its normal size and was composed of a mass of cysts, which ranged in size from that of an egg to a pea. A nephrectomy was evidently indicated; but, before removing the organ, Dr. Kammerer said he decided to inspect the opposite kidney, and found it in precisely the same condition, with the exception that the organ was not so large. He thereupon incised the left kidney, opening the various cysts and making a large incision down through the whole mass into what seemed to be the pelvis. The wound, which was left wide open and drained, closed in the course of some weeks, and the patient made an uneventful recovery. Nothing was done to the right kidney. Since the operation, the patient has gained much in weight, and he seems to be enjoying very good health at present. The case is interesting as showing how the function of the kidneys may be carried on in spite of the fact that very little normal kidney substance is left.

Dr. Kammerer said that this man's urine was examined last week; it contained considerable pus and some albumen, corresponding to the serum of the pus; no sugar and only eight-tenths per cent. of urea. The man urinates three or four times daily, but the exact quantity passed in twenty-four hours could not be ascertained; therefore the percentage of urea stated above was not an entirely reliable index of the amount of urea excreted. From the patient's statement, it might, however, be inferred that he passed a small amount of urine; at all events, it seemed probable that the renal function was very seriously impaired.

DR. CURTIS said he thought Dr. Kammerer acted wisely in not removing the left kidney without waiting to ascertain the condition of the opposite one. It was rather surprising that the incision into the kidney healed so readily. Dr. Curtis said that in 1890 he operated on a woman, twenty-nine years of age, with a very large tumor of the left kidney extending from the diaphragm to the pelvis, while the opposite kidney was apparently normal. Upon cutting down on the left kidney it was found to be a congenital cystic kidney which was made up of cysts of all sizes, from that of a pin's head to a hen's egg. Many of the cysts were opened in the wound until the tumor was reduced to about half its size, and there was probably some communication established between the wound and the pelvis of the kidney, as blood escaped

through the bladder. The wound was drained, a urinary fistula was established, and the patient did very well. Three months later, owing to retention, the tumor again increased in size. The old wound was thereupon reopened and several of the cyst-walls again thoroughly broken down. Since then there has been no further trouble on that side, the fistula continues, and the patient is able to work comfortably. But in the meantime the opposite kidney had steadily increased in size until it is nearly as large as a man's head, which is about the size of the left kidney since the operation. The operation was rendered necessary because the large tumor pressed upward on the stomach and diaphragm, and gave rise to vomiting and hystero-epileptic attacks. As long as the tumor drains freely, the woman remains free from these symptoms.

In reply to a question, Dr. Curtis said there had never been any suppuration in this case.

DR. KAMMERER said it was the presence of pus in the urine that had induced him to operate in his case. On this account, too, it was rather remarkable that the wound had closed so readily; and the speaker said he could only explain it on the ground that, after the various cysts had collapsed, the pelvis of the kidney was drained in a downward direction through the ureter into the bladder. The patient has gained over thirty pounds since the operation.

EXTENSIVE ANGIOMA OF THE FACE TREATED BY ELECTROLYSIS.

DR. CHARLES N. DOWD presented a child, five years old, with an extensive angioma of the face which had been treated by electrolysis. The lesion had originally covered the left temporal region and was very bulky, so that it hung downward over the eye. There was another large spot at the end of the nose and one on the left cheek. Treatment was begun in October, 1899, when several punctures were made with the electrolytic needle: the negative pole was used, with a strength of about five or six cells, sufficient to produce a little bubbling. Nothing more was done until a year later. By that time the appearance of the lesion had greatly improved as the result of shrinkage. A few more punctures were made in a similar manner, and a month later a few additional punctures were made. These have produced a striking improvement in the appearance of the lesion, and the moderate

amount of angiomatous tissue that still remains can be made to disappear almost completely by a repetition of the treatment. Long periods of time should be allowed to elapse between the treatments, on account of the remarkable shrinkage that occurs after the punctures. The treatments were given under ether anaesthesia. The current should be strong enough to produce a slight foaming at the point of insertion. If the needle was pushed in about an inch or an inch and one-half and then brought to the surface, the latter would present a blanched area; sometimes there was a little bleeding.

Dr. Dowd said that, in addition to the angioma, this child had a deformity of the left ear; the ear was thick and was turned forward. This was corrected by a plastic operation: an elliptical piece of cartilage being removed and a much larger elliptical piece of the skin back of the ear. The edges were then stitched together and the ear held in position by bandages.

EXCISION OF THE KNEE-JOINT.

DR. CHARLES N. DOWD presented a man, thirty-two years old, who first noticed symptoms pointing to the right knee eight years ago. These symptoms subsided for a time, but soon reappeared; the knee became swollen, and there was gradual loss of motion. When he came to the hospital there was an irregular swelling occupying particularly the inner side of the knee-joint. The circumference of the knee was three-quarters of an inch greater than that of its mate, while there was an atrophy of two inches at the thigh and an inch and a quarter at the calf, as compared with the opposite side.

Since palliative measures had been tried for a long time without any benefit, excision of the joint was resorted to. The synovial membrane was found to be diseased, together with superficial involvement of the head of the tibia and femur and the posterior surface of the patella. After removal of about an inch from each bone, the bony tissue was found to be healthy. The bones were then united with chromic gut stitches and the skin with silkworm gut. Then a large spica dressing was put on and left undisturbed for seven weeks, a window being made at the end of two weeks for the purpose of removing the drainage tubes. The leg is now two inches shorter than its fellow and is in good position. The final result is still somewhat in doubt, as the man is just out of

bed; but the ankylosis is almost complete, and the union of the tendon of the quadriceps extensor is firm.

EXSTROPHY OF THE BLADDER.

DR. FRANK HARTLEY read a paper with the above title, for which see page 25.

DR. LILIENTHAL said the reader had called attention to the fact that in certain cases it was absolutely necessary to resort to intestinal implantation, and also that these patients sooner or later developed a kidney disease due to an ascending infection. In order to obviate this, the speaker suggested that it might be possible to *exclude* a section of the gut, for example, the large intestine from the cæcum to the beginning of the transverse colon, with anastomosis of ileum into transverse colon, and then to implant the ureters into this excluded section. This being a clean piece of bowel, the chances for infecting the kidney would be less than where the implantation was made into a functioning section. A valve fistula in the cæcum would then permit of the periodical emptying of this reservoir.

Stated Meeting, April 10, 1901.

The President, B. FARQUHAR CURTIS, M.D., in the Chair.

ARTHROTOMY FOR LOOSE CARTILAGE IN THE KNEE-JOINT.

DR. GEORGE E. BREWER presented a man aged thirty-six years, who was admitted to the surgical service of Roosevelt Hospital in August, 1900. He stated that for several months he had been troubled with attacks of pain and stiffness in the left knee. These attacks would come on suddenly without any exciting cause, and would be followed by soreness in and about the joint and a temporary swelling. The attacks were described as beginning by an acute pain, generally on the inner side of the joint, which was so severe as to preclude the possibility of any

movement for several moments. The knee would then be held in a semiflexed position by a spasm of the muscle, which relaxed only after several hours. Occasionally he has been able to feel a movable body in the region of the patella. This would disappear at times and would not be felt for many days. At other times it was constantly present in this region. On admission to the hospital the joint was swollen and contained a moderate amount of fluid, and was slightly tender to the touch. There was no muscular rigidity, and flexion was but slightly impaired. After a week's rest in bed, under chloroform anæsthesia the foreign body was by gentle pressure brought to the inner side of the patella and firmly held by an assistant. An incision was then made about one inch in length, dividing the skin, subcutaneous tissue, and fibres of the quadriceps muscle. These tissues were held apart by retractors, when the foreign body could be felt just beneath the capsule of the joint. A short incision was then made and the foreign body easily removed. The surface wound was then irrigated with salt solution and the wound united by layers without drainage. The leg was then dressed in the usual way and encased in a plaster-of-Paris splint. Its recovery was uneventful. The foreign body was found to be a piece of cartilage about the size and shape of a large Lima bean.

FÆCAL FISTULA FOLLOWING GUNSHOT WOUND.

DR. BREWER also presented a man who was admitted to the Roosevelt Hospital in February last. He stated that fourteen months before his admission he was shot in the back during some manoeuvres of the Russian army. The ball entered the tissues overlying the left innominate bone, penetrating that bone about two inches below its crest, and emerging at a point about one inch below and to the left of the umbilicus. The anterior wound healed under appropriate treatment, but the posterior wound remained open and was the source of a foul discharge for a long period of time. Some months later an operation was performed in another hospital. This operation consisted in an extensive exploration of the posterior wound, but was not followed by any improvement in the symptoms. On his admission to the hospital a probe could be passed for a distance of seven or eight inches, and apparently entered the abdominal cavity. The discharge from the sinus was abundant and of a fæcal odor. Gas was frequently expelled

with the discharge. In this case there evidently was a sinus connecting with the intestinal canal, presumably the colon. As one operation from behind had already been unsuccessful, it was determined to explore the abdomen from in front. Accordingly, under chloroform anæsthesia, an incision seven inches in length was made along the outer border of the left rectus muscle. On opening the abdomen the sigmoid flexure was drawn into the wound and examined, but nothing abnormal was found. The descending colon was next explored, together with the neighboring loops of small intestines, but nothing abnormal was found. A probe was then introduced through the posterior opening and its extremity felt apparently within the lumen of the descending colon, which it entered from behind between the two layers of the mesocolon. An incision was then made through the parietal peritoneum to the outer side of the colon in the immediate vicinity of the sinus. The colon was recognized and drawn towards the median line; its posterior third was found to be embedded in a mass of firm adhesions; this mass was carefully dissected from the quadratus muscle and a cavity opened which connected with the intestine by means of a minute opening. On further retracting the colon and exposing this opening, the mucous surface of the interior of the canal could be distinctly seen. The cavity was thoroughly disinfected with peroxide of hydrogen and salt solution, its walls curetted, and a small drainage tube introduced through the external sinus. The wound into the colon was then sutured in three layers,—the first closing the mucous membrane with catgut sutures, the second inverting the muscular coat with silk sutures, the third turning in a layer of parietal peritoneum which had been left for this purpose when the peritoneum was incised. The abdominal wound was then closed with silkworm-gut sutures, the usual dressing was applied, and the patient placed in bed. The operation was a long one, and was followed by considerable shock. On the second day there was a distinct rise in temperature and well-marked symptoms of pneumonia developed. The abdominal condition being satisfactory, the wound was not dressed for several days. The pulmonary complication was of short duration, however, the temperature having fallen to normal on the fifth day. The external wound was irrigated through the drainage tube for several days, after which the tube was removed. The discharge at no time presented any

evidences of faecal contamination, and no gas has escaped. When the patient left the hospital there was a granulating area and a short sinus. The patient is rapidly improving in health.

PROSTATECTOMY.

DR. ALEXANDER B. JOHNSON presented a man, fifty-eight years of age, who came under his care early in February of this year. He had suffered from progressive symptoms of prostatic obstruction during the past four years. His first attack of retention had occurred six months ago; since then intermittent catheterization had been practised. The introduction of instruments had been followed on several occasions by chills, fever, and more than once by profuse bleeding. He had lost flesh and strength, and suffered from frequent and painful urination during the night and day. For a fortnight previous to coming under Dr. Johnson's care absolute retention had been present. Physical examination showed him to be an emaciated and anæmic individual, whose face expressed constant suffering. There was complete inability to void urine. The introduction of a catheter showed the presence of a fairly severe cystitis with acid urine. Examination per rectum showed a marked enlargement of the prostate of an uneven character. The left half of the gland was nearly double the size of the right. The prostate was removed by the perineal route, under ether anæsthesia, on February 15, 1901. A small incision, two inches in length, was made vertically just above the pubes into the prevesical space, for the sake of palpating the median portion of the prostate and of making counterpressure against the gland during its enucleation. The bladder was not opened. A sound was then introduced through the urethra into the prostatic portion. A curved incision convex forward was made in the perineum extending from one ischial tuberosity to the other. This incision crossed the perineum slightly in front of the point of junction of the muscles of the urethra and the anal sphincter muscle. After exposure, this tendinous raphé was cut and the rectum separated from the urethra by blunt dissection by the finger exposing the prostate. The left forefinger was then introduced into the suprapubic wound and the prostate was crowded down into view. After incision of the capsule upon either side in the direction of the fibres of the leva-

tor ani, the two halves of the gland were enucleated with the forefinger. The median portion came away with the left or larger lobe, and a small rent was made in the mucous membrane covering the median projection. This rent served for the introduction of a large rubber catheter into the bladder for purposes of drainage. The spaces upon either side left by the removal of the two lateral lobes were lightly packed with iodoform gauze. The bleeding during the operation was trifling. Suture of the suprapubic wound. The patient did not suffer appreciable shock. There was a rise of temperature on the second day to 101° F., and an occasional temporary rise thereafter until the fourth day. The perineal tube was removed on the ninth day, after which a 28 French sound was introduced through the urethra into the bladder every three days. There were also daily washings of the bladder, at first through the perineal tube, and afterwards through a catheter introduced through the urethra. The suprapubic cut failed to heal *per primam*, no doubt on account of the introduction of a finger imperfectly disinfected. The infection, however, was slight. The patient continued to leak to some extent through the perineal wound for three weeks after the operation, after which all the urine was passed through the urethra. His bladder was irrigated daily until March 26, since when no treatment has been pursued. At the present time his general appearance has greatly improved; he has gained flesh. He urinates with normal frequency and without pain or discomfort. The amount of residual urine is two drachms. The urine is clear and free from evidences of cystitis.

DR. HOTCHKISS said that about four years ago, in doing a perineal cystotomy for drainage in the case of a badly infected and much contracted bladder secondary to an enlarged prostate, he had demonstrated the feasibility of removing the entire prostate through perineal incision without making a cut above. After doing the external urethrotomy, and upon inserting his finger through the perineal wound into the bladder, he accidentally came upon the line of cleavage between prostate and deep urethra which has been described, and enucleated the entire gland easily; and this procedure, the speaker thought, could be carried out in cases where the perineal distance is short.

KEEN'S OPERATION FOR SPASMODIC WRY-NECK.

DR. OTTO G. T. KILIANI presented a man, aged thirty-six years, who gave no specific history, and who had never before suffered from any nervous affection, although all the members of his family were of a nervous type. About four months ago, the patient, while sitting in a barber's chair, first noticed that his head showed a tendency to turn towards the right side. This tendency continued to grow worse; the range of motion of the head increased and the spasm became more violent, sometimes continuing night and day for many hours. Various drugs and methods of treatment were tried without resulting benefit; and finally the case was referred to Dr. Kiliani by Dr. George W. Jacoby, and it was decided to resect the spinal accessory nerve on the left side. This was accordingly done on the 7th of March, 1901. The nerve was found after some difficulty, on account of the marked hypertrophy of the platysma muscle, and divided, and fully an inch was removed. Because of the time consumed in making this dissection, it was decided to postpone the second stage of the operation. After the operation, it was noticed that the type of the spasm was altered: instead of the head being thrown to the right, it merely turned, and the patient was able to sleep without the aid of narcotics. Two weeks later the operation was completed by resecting about two inches of each of the four cervical roots of the nerve. This was done through an incision seven inches long, running from behind the right ear to the shoulder, with a cross incision below. The wound healed readily.

Since the completion of the operation, the man's head has turned slightly to the right, and so long as it remains in that position the spasms cease; they reappear, however, in a mild degree when he attempts to turn the head. The improvement is not quite as marked now as it was immediately after the operation was done. Dr. Kiliani said the only explanation he could offer for the fact that the spasms were not cured entirely by resecting the nerve and its roots was that the innervation of the affected muscles is not unilateral, but bilateral. Neither Keen nor Powers, who have done this operation, reports a complete cure.

DR. F. LANGE said that many years ago he operated on a case of spasmodic wry-neck by severing the muscles on the affected side. The spinal accessory nerve was stretched. The operation resulted in a transient cure.

DR. HOTCHKISS, who assisted at the case which was operated on by Dr. Powers, said that all the nerves on one side were divided. The result was not as good as in the case shown by Dr. Kiliani. The character of the spasm was altered.

DR. ROYAL WHITMAN suggested the use of a temporary support to assist the patient in keeping his head in the corrected position, as this evidently required considerable effort. In addition to this, proper exercises might prove beneficial.

DR. JOHN ROGERS said he had seen one case where both spinal accessory nerves were cut. After one had been severed, the head turned in the opposite direction. The patient refused to have the posterior roots of the nerve resected. A plaster-of-Paris support was applied to the head, but this had to be taken off, as the friction of the plaster caused abrasions of the skin of the cheeks. The operation was followed by very little atrophy of the muscles, and the strength of the trapezius was but slightly impaired. The man can bring his arm forward and raise it up from his side.

Dr. Rogers referred to another case, which he showed to the Society some months ago, where the spinal accessory nerve was supposed to have been accidentally cut in the course of an operation for the removal of some enlarged glands in the neck. The operation was followed by marked disability in the muscles on the affected side, especially in the trapezius. Some of the members were inclined to attribute his paralysis to an old fracture of the skull, but neurologists who have since seen him state that that has nothing to do with the disability of the upper extremity.

DEFORMITY FOLLOWING RESECTION OF THE KNEE IN A CHILD.

DR. ROYAL WHITMAN showed a little girl, a native of Hungary, whose left knee-joint became affected with tuberculosis two years ago. Five months ago a partial resection was performed at a hospital in this country, and shortly after the child was discharged, apparently cured. Deformity soon appeared and rapidly increased, and at the present time the limb is fixed at practically right angular flexion.

Dr. Whitman said that after resection of the knee in childhood, or, in fact, whenever ankylosis was present from whatever

cause, the joint ought to be protected for a long time afterwards in order to prevent deformity. The loss of growth resulting from even partial resection, together with the fact that mechanical treatment was required for an indefinite period, practically contraindicated this operation in early life.

DR. CURTIS said that a year ago he operated on a girl of eighteen whose knee had been resected for traumatism of the knee when she was two years of age. This resulted in flexion contracture and great loss of growth in the affected limb, and the knee became ankylosed at right angles. Dr. Curtis resected the knee-joint and straightened the leg. There were over six inches of shortening on the affected side.

The speaker said he agreed with Dr. Whitman that a protective splint should be worn after these operations, especially in children.

DR. WILLY MEYER said that in the case shown by Dr. Whitman the condyles were apparently not removed. The operation was an atypical resection, or, more properly speaking, an arthrectomy.

NON-DEVELOPMENT OF THE INFERIOR MAXILLA.

DR. WHITMAN showed a case of impaired development of the lower jaw in a girl thirteen years of age. At the age of four, the father states, the child had typhoid fever complicated by some inflammatory trouble about the jaw, which necessitated the removal of all but two of sixteen teeth. It seems probable that the loss of function would account in part, at least, for the loss of growth.

DR. LANGE, after examining the patient, said the left half of the lower jaw seemed to be normal in length, while the right half was shrunken and pushed out of its proper position. In addition to this there is a bony projection growing from the inner side of the middle of the chin, and the motion of the right temporomaxillary joint is somewhat impaired. The speaker said he did not know how to account for these abnormalities, except that perhaps they were due to some injury or inflammation of the jaw-bone which had disturbed its development. The extraction of the teeth had probably been a secondary indication, and had not been the cause of the abnormality presented.

UNUNITED FRACTURE OF THE TIBIA.

DR. WHITMAN presented a boy who was injured by a trolley-car two years ago, sustaining a compound fracture of the tibia and fibula of the left leg. He was treated for a long time at a hospital, and finally, as the bones failed to unite in spite of operative intervention, he was discharged, wearing an apparatus on the affected side. Last August he was admitted to the Hospital for Ruptured and Crippled, and upon examination it was found that there was absolute failure of union of the tibia. This was apparently due to a marked equinus, and to the fact that the fibula was too long. The bones were thereupon exposed, the fibula divided and overlapped, the extremities of the tibia freshened and fixed in apposition. Union took place after some delay. Subsequently the tendo Achillis was divided and a temporary apparatus applied. The limb is now practically perfect in function.

RESECTION OF THE ELBOW FOR TUBERCULOUS DISEASE.

DR. L. W. HOTCHKISS presented a young man, twenty years old, upon whom he had operated six years ago at Roosevelt Hospital for extensive tubercular disease of the left elbow-joint. A wide resection was made, a section of bone being removed from the humeral and lower extremity of the joint. The result of the operation was very satisfactory. The joint has a wide range of motion, and is so strong that the patient can do hard labor without any trouble. He recently came under observation again because of the occurrence of a tubercular skin lesion in the region of the elbow on the affected side. The case was shown as an example of rather unusually good result, in that there was free motility and great power in the excised joint.

EXTENSIVE FIBROMYOMA OF THE UTERUS.

DR. F. LANGE presented a patient, thirty-four years of age, from whom he had removed four years ago a large fibromyoma of the uterus with broad base and subserous development, to illustrate an abdominal incision, which as a modification of Bardenheuer's incision seems well adapted to this class of cases. It is a combination of a median cut and a cross incision which includes the upper edge of the symphysis, both incisions together forming an anchor the size of which must correspond to the

requirements of the case. In the one presented, an operation had been tried two years before by an expert gynaecologist, but had been abandoned on account of great difficulties met with. The adhesions now had naturally become more extended. In one place where an encysted small abscess with ligatures was found, the gut had to be repaired by suture. Appendix was also removed. The object of including the shell of bone, to which the recti abdominis are attached, in the lower cross incision, is to secure a firm union and to prevent the formation of hernia. If the incision is carried above the symphysis, sutures will easily cut through the fleshy and even the tendinous portion of these muscles under fits of coughing or vomiting. Bone suture through the pubic bones is reliable. Dr. Lange had tried it with silkworm-gut and silk with equally good results. The scar in the case presented, which projects on either side a good deal beyond the symphysis, is everywhere strong and reliable after four years have elapsed since the operation. Another feature of interest was the attempt to prevent the agglutination of intestine to the anterior abdominal wall, which offered no peritoneal covering after removal of the growth. For this purpose the large omentum was unfolded and its lower edge pasted on behind the pubic bones. Dr. Lange emphasized the importance, in such extreme cases, of reducing the hæmorrhage to as small a degree as possible. The prolongation of the operation by the more complicated incision is fully made up by the directness with which one gets to the principal vessels of the growth and the possibility of seeing what one does. Again, shock is much more easily overcome by patients who have a sufficient reserve of blood. In the case presented, the operation lasted five hours, including saline infusion and up to the time when the patient was removed from the operating-table. She made an excellent recovery.

SKIN-GRAFTING IN THE TREATMENT OF COMPLETE STENOSIS OF THE LARYNX.

DR. A. J. McCOSH read a paper with the above title, for which see October issue of *ANNALS OF SURGERY*.

DR. ROGERS said that he had treated twelve cases of chronic laryngeal stenosis by means of intubation tubes, with only one failure, though two were still under treatment. Nine or ten of these were of the postdiphtheritic variety; the others were cicatricial. The former are more easily relieved than the latter. In

the treatment of this condition by intubation, the largest possible sized tube should be introduced, and left there undisturbed for as long a period as the patient can comfortably wear it. At first it is apt to cause considerable difficulty in swallowing, especially in adults. It is a safe and sure method of treatment, though slow, and can be used even in the most extreme stenosis after division and dilatation of the stricture.

DR. CURTIS referred to one case of stenosis of the larynx upon which he had operated about ten years ago. In that instance there was cicatricial contraction due to syphilitic ulceration. Through a tracheotomy wound an Otis urethrotome was passed upward and the cicatricial tissue incised; this passage was then dilated until a canal was made which was sufficiently large for the patient to breathe through without the aid of a tracheotomy tube. The patient was then turned over to a laryngologist, who succeeded in dilating this passage still farther from above. This proved very difficult, however, as the man had had a fracture of the lower jaw, which had united with deformity, limiting the space in the mouth. The larynx subsequently closed up again, necessitating the reintroduction of the tracheal tube. When Dr. Curtis again saw the patient, about two years later, he learned that another laryngologist had succeeded in again dilating the passage through the larynx, and since then it has remained patent without requiring much further treatment. He wears no tracheal tube, although a minute opening still exists at the site where it was worn. This case proves that such extensive contractures can be successfully treated by dilatation, and will remain permanently patent.

For the very severe cases of laryngeal stenosis, Dr. Curtis said that grafting as used by Dr. McCosh appears to be a promising procedure.

DR. MCCOSH, in closing, said that in addition to the case reported, he had seen two similar cases where there was absolute closure of the larynx and upper section of the trachea. Such cases are entirely unsuitable for intubation, as no instrument can be introduced from above. The speaker recalled the case of a boy upon whom he had operated for the relief of obstruction due to papilloma of the larynx. At the end of a year cicatricial tissue completely filled up the larynx and trachea above the tracheal tube, which he had worn since the operation. Another operation was contemplated, but the boy died of pneumonia, and the

autopsy showed that both the larynx and trachea were completely occluded by dense cicatricial tissue.

NEPHRECTOMY FOR TUBERCULOSIS UNDER
SPINAL ANÆSTHESIA WITH TROPA-
COCAINE.

DR. WILLY MEYER presented a kidney removed for tuberculosis. He said that he did so not so much for the sake of showing the specimen as in order to relate the interesting history and details of the operation. The latter had been done under spinal anæsthesia with tropacocaine.

The patient, a man of twenty-seven, had been subject to pain in the left lumbar region for the last three years. For the past six weeks pain had also been present in the region of the right kidney. He had been suffering with hectic fever and cough for quite some time, and was so much distressed by the pain in his left side that his gait was stiff, the upper half of the body being turned towards the left. Sleep was very poor. Urinary analysis showed all the symptoms of pyelonephritis and cystitis; the urine was loaded with almost pure cultures of tubercle bacilli. Amount of urea discharged within twenty-four hours was much reduced (twelve grammes). Tubercle bacilli were also found in the sputum. In view of the reduced amount of urea, it was clear that both kidneys were involved. Under ordinary circumstances, the speaker said, he surely would have refrained from operative interference, but would have sent the patient South and placed him on general *régime*. However, the suffering in this case was so great that operation was clearly indicated. For the purpose of determining which side was principally diseased, cystoscopy was attempted, but without success, owing to the far advanced involvement of the bladder. Had the patient not been feverish, the operator would have followed his usual method of procedure, viz., that of first treating the bladder with regular irrigation, thereby improving the vesical catarrh. He stated that he had frequently succeeded, by such preparation, in rendering cystoscopy successful, and then, by finding one mouth of the ureters healthy and the other one diseased, in determining which side was principally involved. As it was, the plan of preparatory treatment had to be abandoned. Dr. Meyer therefore relied mainly on the symptom of pain, which, in tuberculosis, generally is a pretty safe guide in locating the trouble, although it is not

entirely trustworthy. The speaker cited a case where pain had been complained of in one lumbar region only for years, tubercle bacilli were found, but cystoscopy and catheterization of the ureters proved the seat of the disease to be on the other side, the one afflicted with pain being healthy.

As general anæsthesia would have been a perilous undertaking in view of the bilateral kidney affection and the patient's general condition, spinal anæsthesia was resorted to, and tropacocaine, recommended by Schwartz, of Agram, was made use of for the first time by Dr. Meyer. Tropacocaine, he stated, had been tried by a number of surgeons for various purposes, and had been found to be quite as effective and less than half as toxic as cocaine hydrochlorate. Its solution is more stable and seems to stand boiling. In connection with spinal anæsthesia, it has the additional great advantage of not producing those well-known after-effects observed after the use of the ordinary cocaine.

In order to have the analgesia reach up as far as possible, five centigrammes of tropacocaine were dissolved in fifty minims of sterilized water and injected between the fourth and fifth lumbar vertebræ. Analgesia was ideal. The patient's attention was diverted by the administration of a mixture of two-thirds of water and one-third of alcohol on Esmarch's mask,—a deception which, the operator said, he had often found helpful in quieting the apprehensions of nervous subjects. The patient did not feel anything of the operative procedure; resection of the twelfth rib, which had to be done in order to gain better access, passed unnoticed; traction on the upper half of the kidney, however, was felt, showing that that part evidently had not been fully reached by the effect of the injected drug.

The kidney showed an enlarged pelvis; many tubercles, larger and smaller, were seen on the outer surface of the organ; yet some doubt was entertained whether this was the kidney principally diseased. In view, however, of the history of the case as stated above, the peculiar gait of the patient, also on account of the wearing off of the analgesia, it was not deemed advisable to cut down on the other kidney; so the left one was removed. On section it showed numerous tuberculous infiltrations starting from the pelvis, and a tuberculous, cheesy deposit in one of the calices. The speaker regretted not having tested the calibre of the ureter. He feels convinced that a stricture on

a tuberculous basis was present, to which the enlargement of the pelvis, probably also the continuous pain, was due. The patient felt perfectly well after the operation. There was no vomiting, no chill, no fever, no headache nor neuralgia. In fact, all the symptoms so frequently seen after spinal anæsthesia with ordinary cocaine were absent. The claims of Schwartz were entirely corroborated by this case. During the first twenty-four hours the patient passed twelve ounces of very purulent urine; in the first half of the second day only eight ounces; then total suppression set in. It was evident that the ureter of the remaining kidney had become obstructed. Therefore, seventy-two hours after the first operation the other kidney was cut down upon, again under spinal anæsthesia with tropacocaine. This time only four centigrammes were injected. Analgesia of the deeper tissues, however, was less satisfactory than at the first operation. Resection of the twelfth rib again was painless. The right kidney was found to be in cystic degeneration, the cysts being filled with pus. They were evacuated by free incision. The patient stood, also, this operation very nicely, and suffered no after-effects from the tropacocaine. However, he sank steadily and died, with subnormal temperature, four days later.

The speaker fully admitted that it would have been wiser to have cut down on the right kidney after having exposed the left one. However, the reasons mentioned above prevented him from doing so. In another similar case, he said, he would rather risk giving the patient a few whiffs of general anæsthesia.

The case illustrates the difficulties sometimes encountered in advanced cases of bilateral renal tuberculosis where cystoscopy is unsuccessful. It further shows the unreliability of pain, in tuberculous disease, as a guide in determining the side principally diseased. And lastly, it demonstrates very nicely the superiority of tropacocaine over the ordinary cocaine in cases of spinal anæsthesia. Since this operation, Dr. Meyer has used tropacocaine in two further cases,—one, a nephrotomy; the second, a suprapubic cystotomy for tumor; and in neither of them did he observe any of the annoying after-effects usually following the employment of the ordinary cocaine.

This certainly, he believes, means a great progress in spinal anæsthesia. Careful clinical observations are necessary, however, in order to further develop this interesting method of producing analgesia in a larger part of the body.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, March 4, 1901.

The President, DE FOREST WILLARD, M.D., in the Chair.

SARCOMA OF SUPERIOR MAXILLA.

DR. RICHARD H. HARTE presented again a man whom he had presented about a year before to show the result following an operation for the removal of the superior maxillary bone in which he had to place a large skin-flap to cover up a defect in the anterior part of the cheek. Since the operation the man has gradually improved in health, and has had nothing done to the persistent disease except the removal of a small mass which appeared a few months ago in the region of the angle of the jaw. This was done by Dr. Le Conte. The man has gained steadily in strength, looks perfectly well, and is able to do the ordinary work of a day-laborer. There is an opening leading from the roof of the mouth, and posterior to that there is a small cystic mass corresponding to a portion of the soft palate, which Dr. Harte expected to remove in a short time.

DR. LE CONTE said that he could thoroughly bear out Dr. Harte in his statement that this case was a most unfavorable one for operation. The growth was not only in the antrum, but had extended to the skin surface and had ulcerated, a fungoid mass appearing, possibly the size of a quarter of a dollar, over the cheek, which necessitated not only the removal of the upper jaw, but likewise the removal of the larger portion of the skin which covers the upper jaw, and necessitating plastic operation to cover in the defect.

FRACTURES OF THE SKULL.

DR. RICHARD H. HARTE read a paper with the above title, for which see October issue of the ANNALS OF SURGERY.

NEUROPATHIC AFFECTION OF THE BONES.

DR. CHARLES H. FRAZIER presented a man, sixty years of age, by occupation a freight conductor; a moderate user of

tobacco and alcohol; never contracted syphilis. At the age of twenty-five he began to complain of occasional shooting pains in the left tibia, at first referred to a portion, now to the entire, shaft. Associated with the shooting pains, which have increased in severity and frequency, is a hypertrophy of the bone throughout its entire length. Five years ago the patient began to notice some disturbance of function in the right knee; at present he can neither fully extend nor fully flex the joint.

Examining the skiagraphs that were made of the left and right knee-joints and of the left and right shafts of the tibia, one notes that the breadth of the articular ends of the bones entering into the conformation of the right knee-joint is considerably greater than that of those bones entering into the conformation of the left knee; that, furthermore, there are sprouting from the articular surfaces of the joint bony outgrowths, osteophytes, or exostoses which spring probably from the edges of the articular cartilage. The skiagraphs of the shafts of the right and left tibia differ from one another in that the shaft of the left or affected bone is broader, denser, and more irregular in outline. The medullary cavity is demonstrable in the skiagraph of right tibia, not of the left. Further than this no information can be gathered from the skiagraphs.

The conspicuous features of the case worthy of attention are these, to wit:

(1) An affection of the osseous system bilateral and asymmetrical in its distribution.

(2) Beginning at the age of twenty-five and extending over a period of thirty-five years.

(3) Not affecting in the slightest degree the patient's general health.

(4) Running an afebrile course.

(5) In which pain is the most conspicuous, in fact the only, subjective symptom.

(6) With no apparent tendency to progressive involvement of other bones or other joints.

(7) With no concomitant lesion in the bones of the face or cranium, or the bones of the trunk, vertebra included.

(8) The pathologic process being essentially a formative one, that is, one attended with generation, and not with destruction, of bone, a process which from the apparently increased

density of the left tibia, as demonstrated by the skiagraph, is one akin to osteosclerosis rather than osteoporosis.

(9) An affection of obscure origin, in so far as it is not traceable to infection, to traumatism, or to any demonstrable lesion of cord or brain.

Dr. Frazier said that he (1) could conceive of an osteoperiostitis of a syphilitic nature, slow but progressive, gradually involving the entire shaft of tibia; a bone which might be said to be the seat of predilection for syphilitic lesions, an osteoperiostitis attended with generation of bone by ossification of the inflammatory exudate, which would account for the present condition of the left tibia.

(2) Knowing how many years the typhoid bacillus lies dormant in the system without setting up any inflammatory reaction, one might be tempted to hold this organism responsible for the condition of the left tibia, were it not for the fact that the patient has never had typhoid fever.

(3) Disregarding for the time the left tibia, one might say that the presence of the osteophytes or exostoses along the margin of the articular surfaces were suggestive of the condition met with in the early stages of osteoarthritis.

(4) Again, the enlargement, especially of the articular ends of the long bones, calls to one's mind Marie's disease, the so-called hypertrophic osteoarthropathy, which is for the most part a pulmonary affection accompanied by enlargement of the extremities.

No one will take exception to the statement that this case presents an unusual and an atypical manifestation of one or another of the bone-affecting diseases. That it is not of infectious origin, inflammatory in nature, Dr. Frazier was convinced. Reasoning by the process of exclusion, there remains for consideration that class of bone diseases which, for want of a better name, is called neuropathic or trophoneurotic, a class including such affections as Marie's disease, as acromegaly, as leontiasis ossea, as Paget's disease (osteitis deformans), a class having many features in common: beginning at or after middle age, *i.e.*, in the decline of life; of duration unlimited, the affected individual dying of some intercurrent affection; the process primarily an osteoporosis, secondarily an osteosclerosis, and essentially formative and associated with hypertrophy of the bones

involved; the symptoms almost wholly objective; the prognosis favorable as to life, but absolutely unfavorable as to recovery, occasionally the process being arrested; the treatment purely symptomatic.

As to the characteristic features of each of these affections: in acromegaly they are enlargement of the inferior maxilla, the supraorbital ridge of the hands and feet; in Marie's disease they are the enlargement of the articular ends of the bones, especially those entering into the elbow, shoulder, knee, wrist, and fingers. There is no lesion in cranial or facial bones; in osteitis deformans there are enlargement of the bones of the skull and of the tibiae and femora together with a kyphosis in the cervico-dorsal region, a symptom common to both acromegaly and Marie's disease. The lesions of leontiasis ossea are confined to the bones of the face, of which the superior maxilla is the first to be attacked.

Were it necessary to classify the affection as exhibited with any one of these classes the reporter would be disposed to select osteitis deformans, realizing that one is but an incomplete picture of the other; that instead of the lesions being widely distributed, the process is confined to but one bone of the left leg and to one articulation of the right.

CÆCAL HERNIA.

DR. FRANCIS T. STEWART and DR. JOHN H. GIBBON read papers on cæcal hernia, for which see page 155.

DR. WILLIAM J. TAYLOR said that Dr. Gibbon attributes the formation of this hernia to the mesentery or long mesocolon. The speaker, however, thought that Mr. Jonathan Hutchinson, Jr.'s, dissection of monkeys to be rather against such a conclusion. Hutchinson has shown, in a very large number of monkeys, that the mesocolon and mesentery are unusually long and free in monkeys, and yet hernia is almost unknown among them. The mesentery is very much longer than in the human being, and one would suppose that would have a tendency to the production of hernia in monkeys, if that was a factor.

DR. ROSS reported the case of a man operated on by him for right inguinal hernia. The cæcum occupied the sac in this case, due to the fact that the arching fibres of the transversalis and internal oblique, instead of arising from the outer half of Poupart's ligament, started not more than one inch below the

anterior superior spine, so that the external ring was approximately three and a half to four inches long. This man had an undescended testicle, which was removed.

DR. RICHARD H. HARTE said that he had seen a number of cases of cæcal hernia in his hospital practice, and in every instance in which he had operated he had found a portion of the ileum also in the hernial sac. He was convinced that the ileum was the first portion of the bowel to make its descent, and then it gradually dragged the cæcum down later. This seems undoubtedly to be the most rational cause for the cæcum's appearance as a hernial protrusion. This doubtless, on the whole, is due to a relaxation of the mesentery. In regard to Dr. Taylor's remarks in reference to the infrequency of hernia in monkeys, he would say that can be ascribed largely to the position which they maintain in walking, usually going on all fours rather than in the erect posture. If a similar position was maintained in human beings, doubtless hernia would be much less frequent than it now is.

MORTALITY IN OPERATIONS FOR OBSTRUCTIVE JAUNDICE.

DR. JOHN B. DEAVER read a paper entitled as above, for which see page 165.

DR. JOHN H. GIBBON asked whether Dr. Deaver had ever seen death from acute dilatation of the stomach after operation for gall-stones. He did not mean dilatation that results from constriction of the duodenum, from adhesions, but acute dilatation following operation.

DR. DEAVER replied that he had never seen acute dilatation of the stomach in the deaths following gall-bladder surgery. He had had five deaths, but had not seen a death result from that cause. He had seen what might have been diagnosed as acute dilatation of the stomach; but when he followed these cases to the autopsy table, sepsis was revealed. If there is no sepsis, there will be no acute dilatation of the stomach or alimentary canal.

ENTERORRHAPHY WITH AID OF THE O'HARA FORCEPS.

DR. GIBBON said that in a case of strangulated hernia he had had an opportunity to use the O'Hara forceps, where it

worked very well indeed, and it would seem to be particularly commendable in these cases. It does not require any of the methods, such as rubber bands, forceps, etc., for preventing the flow of *fæces* over the wound. In this case he was enabled to do an anastomosis a great deal quicker than if he had used the hands only or the La Place or Downs forceps. The patient died very shortly after the operation from shock. There was every evidence of a perfect anastomosis post-mortem.

THE TREATMENT OF SUPPURATING HÆMATOCELE FOLLOWING EXTRA-UTERINE PREGNANCY.

DR. GEORGE ERETY SHOEMAKER read a paper with the above title, for which see page 159.

DR. DEEVER said that he regarded Dr. Shoemaker's discrimination between free blood and walled-off exudate as very logical indeed, and particularly so when he mentions in one of those cases that the culture showed streptococcus. If he had attempted to make that enucleation through the abdominal route, he would have disseminated sepsis; and if he had, he would have lost his case of peritonitis. He agreed with him in choosing the abdominal instead of the vaginal operation. When one opens the abdomen, one can say, "I am master of what I survey;" but in these cases of walled-off abscess, which they practically resolve themselves into, the surgeon is not master of all he surveys if he evacuates them through the abdominal route, notwithstanding he may be well reinforced with gauze. Infection can be transmitted through the gauze and communicated to a healthy peritoneum beyond. He gave the details of a case of pelvic hæmatocele in the true sense, one having no connection with an extra-uterine pregnancy. This girl was menstruating and dancing. Suddenly she was taken with abdominal pains. Dr. Ross diagnosed internal hæmorrhage. The abdomen was opened for the purpose of establishing the diagnosis, and there was found a hæmatoma occupying the interval between the two layers of the broad ligament. The abdomen was closed; the broad ligament space was opened through the vagina, drained, and the patient made an uneventful recovery. He had disposed of several cases of suppurating extra-uterine pregnancy in that wise. In this class of cases, where a doubt exists as to whether

pus is present, in the absence of the usual constitutional evidence of pus, the blood count is of considerable avail; so that where there is a high grade of leucocytosis, and it is not possible to detect fluctuation by vagina or reach the mass by vaginal touch, it is indicated to open up the abdomen, locating the condition, and then deal with it from below.

DR. ROSS remarked with reference to the case which Dr. Deaver had referred to, where there was a true intraligamentary hæmatocele; this girl was twenty-one years old when the accident happened. At the age of twelve she had had an abdominal abscess, which the doctor diagnosed at the time as appendiceal abscess. As a result of the inflammation, she had very strongly adherent adnexas, which rendered the broad ligament very rigid. It was probably due to the rigidity of the broad ligament that the rupture of the vessel occurred. That was the explanation that seemed most rational to Dr. Deaver and himself in thinking the matter over. He added that there were no indications of pregnancy, either objective or subjective.

DR. SHOEMAKER rejoined that it was not positive that the case mentioned by Dr. Deaver was not one of extra-uterine pregnancy. He did drainage only, and saw nothing to establish the diagnosis. The early rupture of the tube is very commonly downward, and therefore between the folds of the broad ligament, and the escape of blood into the peritoneal cavity is not uncommonly secondary.

INDEX TO SURGICAL PROGRESS.

GENITO-URINARY ORGANS.

I. Prostatotomy and Prostatectomy. By DR. A. POUS-
SON (Paris). All operations on the genital organs, double or
single castration, division of the vasa deferentia, etc., merely
diminish prostatic congestion, and are thus of benefit in more or
less acute retention, but are valueless in complete or incomplete
chronic retention. Pousson considers prostatotomy and prosta-
tectomy proper only in cases in which the hypertrophied parts of
the gland constitute an anatomical obstruction to the complete
evacuation of the bladder. Such anatomical obstruction exists
when an abnormal course of the posterior portion of the urethra
renders catheterization impossible, or when an abnormal neck or
base of the bladder gives the same result. Careful examination
usually permits the diagnosis of such conditions when present.

The author objects to operations performed through the
urethra because one has to work in the dark; he recommends
the suprapubic route.

Out of fifteen cases three died,—all three being aged and
much reduced from long lasting disease. Prostatotomy was only
performed once, and gave an imperfect result, in all the other
cases the operation was prostatectomy. In four patients, ability to
completely and naturally empty the bladder was obtained. In one
such was obtained temporarily. Such results were only secured
in comparatively young persons, in whom vesical infection was
not wide-spread. In the remainder of the cases there was only
a lessening of the symptoms of acute cystitis, the urine was less
purulent, and it became possible to more easily irrigate the blad-
der.—*Bull. et Mém. de la Société de Chirg. de Paris*, Tome xxv,

p. 737.

EXTREMITIES.

I. Subcutaneous Rupture of the Biceps. By DR. LOOS (Tübingen). The introductory remarks appertain to four instances of biceps rupture, at the V. Bruns clinic, and the personal observations, together with a study of sixty-two cases in literature, afford us a most complete picture of the affection. It is encountered between the ages of thirty and seventy, and, while predisposition in a few instances may be traced to some antecedent illness, causing degenerative changes in the muscle, yet the immediate cause is some sudden severe exertion calling forth unwonted co-ordinated movements of the muscles.

Both direct and indirect violence can cause rupture, and these act by stretching the contracted muscle. Most frequently the force is exerted by the long lever of the forearm, and occasionally some anomalous position is at play. Experiments on the cadaver do not coincide with clinical experience as to the site of the rupture, which latter has been found to be typically situated in the long head of the biceps at the point of transition of the tendon into the muscle belly.

Symptoms.—Separation of the fragments incident to elasticity and muscle tonus, with a furrow of variable depth between the two prominent contracted ends. At times, if the rupture line be oblique, only one contracted muscle end is visible. The lower half of the belly muscle is nearer the elbow. If the distal tendon is severed, the reverse obtains. Violent contraction will effect changes in the muscle fragments, each approaching its insertion. These symptoms are all less marked in tendon laceration. Functions peculiar to the biceps are at first greatly impaired, but soon compensated for by synergistic muscles. In the supine position flexion is less possible than in the prone (Gerster). An additional symptom is the loss of fixation that the intact biceps exerts on the humeral head, in consequence of which the humerus subluxates up and inward. In muscle rupture, the hæmatoma is larger than in tendon rupture. Chiefly to be differentiated from rupture is

hernia. The latter sets in slowly, and with the contraction of muscle the tumor disappears. The defect in ruptured muscle is replaced by connective tissue, or subsequently the muscle may be regenerated, or finally fragments of adjoining connective-tissue structures may be interposed.

Treatment is to be directed towards the absorption of the blood by pressure and massage. Acute flexion favors the approximation of the severed ends. The fragment of muscle deprived of innervation is prone to atrophy, to obviate which massage and electricity are to be practised. In one case only was operation performed because of the large defect after three months' standing.

Four months after operation functional result was perfect. In two instances respectively of ruptured tendon and muscle among the sixty-six cases enumerated did marked loss of function persist, wherefore the prognosis may be set down as very good under appropriate treatment.—*Beiträge zur klinischen Chirurgie*, Band xxix, Heft 2.

II. Suture of Subcutaneous Rupture of the Ligamentum Patellæ. By DR. C. BLAUER (Tübingen). The technique consists in awaiting the subsidence of the swelling due to effused blood, and, however long this may be, it can be stated with safety that as long as there are no changes in the articular structures the operative interference will be successful. Any incision that is large enough suffices, yet the longitudinal incision is deemed most practical, since it gives access to the site of rupture at whatever level it may be, whereas a transverse incision may be at the wrong level.

Metal sutures are considered most efficient.

In contrast to Walker's 80 per cent. of cures, Lotheisen's analysis of additional cases is reported to have brought the percentage of cures to 100. The bloodless method of treatment merely offers 75 per cent. cures, therefore the object attained by suture is to shorten the length of time of immobilization, thus

preventing atrophy of the muscles and lessening the period of rest in bed, which is of great import, since the majority of the afflicted are between forty and sixty years.

As in fracture of the patella, the interposition of soft parts interferes with proper healing, so does this hold for ruptured ligamentum patellæ. Therefore all these casualties are at once overcome by the inspection at operation which constitutes the greatest ground for operative therapy. That functional result attained is permanent was adduced in two observations where, three years after, no difference from the normal could be detected.

One peculiarity is recorded in the way of an ossification about the suture, which can only be explained by its direct relation to the original injury. This report sustains the very complete study of Walker on the same subject recorded in the pages of the *ANNALS OF SURGERY*, and of which the author takes full cognizance.—*Beiträge zur klinischen Chirurgie*, Band xxix, Heft 2.

MARTIN W. WARE (New York).

III. Substitution of Toe for Amputated Finger. By DR. VON EISELSBERG (Königsberg). The author reports Nicoladoni's famous case performed in 1898. The thumb of the right hand had been destroyed. The bone in the stump was exposed by the formation of flaps which contained the flexor and extensor tendons. On the back of the base of the second toe of the right foot a short flap was formed having its base downward, and consisting of the skin and extensor tendon. The toe was dislocated at the metacarpophalangeal joint; the proximal end of the first phalanx was cut away; the flexor tendon was divided, but the plantar skin was left as a living bridge. The stump of the thumb was united by suture to the base of the toe, prepared as above; flexor tendon to flexor tendon, extensor to extensor, and dorsal flap of thumb to dorsal flap of toe. The extremities were kept together by an extensive gypsum dressing. After sixteen days the plantar bridge of skin was divided, and the union of toe to hand

completed. After a few weeks the new thumb had a very satisfactory amount of motion.

Encouraged by the above case, Von Eiselsberg replaced the index-finger by means of the second toe. The operation was practically the same as that described above. The plantar bridge of skin or pedicle was divided on the twelfth day, after which the new finger was somewhat pale and cold. *Three leeches placed beside the nail aided much in restoring circulation.* The author has often used this "dodge," e.g., in nasal plastic, and has been much struck with its usefulness. All the transplanted tissues lived, but the operator unfortunately left a wound on the plantar surface to heal by granulation, and, as a consequence, adhesions formed around the flexor tendon. If, when dividing the pedicle, sufficient skin had been taken from the sole of the foot, the plantar wound could have been completely closed and adhesions avoided. As it was, the result was good. The new finger was fairly shapely, had a considerable amount of sensation, especially dorsally, and could be moved passively but not actively. The absence of active motion is accounted for by the adhesions around the flexor tendon.—*Archiv für klinische Chirurgie*, Band lxi, Heft 988.

JOHN FAIRBAIRN BINNIE (Kansas City).

BONES AND JOINTS.

I. Operation of Irreducible Fractures. By DR. O. ROTHSCCHILD (Frankfurt). With the view of still further strengthening the claims of operative interference in these distinctive forms of fracture, forty-five operative procedures are enumerated. The list includes fifteen fractures of the tibia, nine of the humerus, seven of the forearm, six of the thigh, five of the patella, and one of the clavicle. The interposition of soft parts, muscular contraction, pressure on nerves and vessels, and most commonly an oblique line of fracture, constituted the *casus operandi*. The deterrent factor for interference under these circumstances, even

in these days of perfected surgical technique, has been the fear of the additional chances of infection, and this, notwithstanding the great impetus initiated by Listerian methods as demonstrated early in its career in patella fractures, still further insured by the rigid asepsis of to-day. Yet two of the cases among the forty-five suppurated, one terminating fatally.

X-ray examination of fractures has lent additional force to the propriety and necessity of a more frequent interference whenever it is demonstrable that perfect alignment does not exist; and the author holds that to await the possible good functional result, even in the face of a deformity under expectant treatment, is an error.

Operation at the earliest moment, always individualizing, offers the best prognosis. As to technique where defects are large, ivory pegs are of service. Their disadvantage lies in the difficulty of their introduction into the second fragment, when the defect is not great, or where in old fractures retraction of the soft parts is great, and the uncertainty as to their ultimate absorption or removal which was necessary in one-third of the instances. With regard to metallic sutures, the eventual absorption is also open to question, and their removal as foreign bodies is incumbent.

Aluminum bronze-wire, which was employed at Rehn's clinic, is held to be absorbable. The oblique fractures of the leg are largest represented. The opinions of German and French surgeons seem to be in favor of secondary operation, that is after six weeks, when the immediate effects of traumatism have subsided. Their views are freely quoted, whereas the valuable utterances of English surgeons, Lane and Bennett, on operative interference receive no mention, and likewise noticeable is the omission of the trustworthy opinions of Kocher on the indications for operation in fractures involving the elbow-joint. This thesis is timely, but its conclusions are based on a small variety of cases.—*Beiträge zur klinischen Chirurgie*, Band xxix, Heft 2.

II. Traumatic Epiphyseal Separation of Upper End of Humerus. By DR. P. LINSE (Tübingen). Thirty-eight cases are analyzed with the aim of determining the exact site, mechanism, and outcome of these fractures. The greater number were the result of direct violence at the shoulder-joint applied with the arm in hyperextension and rotation. Only twice was the impact of force applied to the elbow. Anatomical studies have shown that the periosteum is intimately attached to the epiphyseal cartilage, in consequence of which a piece of juxta-epiphyseal bone is torn away. These fractures, occurring most frequently during adolescence, are the analogue of dislocation in adults; rotation being the determinant factor in each instance. Males are more frequently affected than females.

Diagnosis.—In the second decennium we get bony crepitus, in the first decennium crepitus is more velvety. The X-ray will be of inestimable service in distinguishing between epiphyseal separation and fracture of the neck of the humerus. Vertical extension while in bed is lauded as most efficient in treating these affections, since it combats the tendency of the lower fragment to inward displacement. The line of fracture being in the juxta-epiphyseal ossified cartilage explains wherefore there is, as a rule, very little or no interference with the subsequent growth of the bone, and where any difference in length of the arm is made out, it likely rests with displacement of the fragments.—*Beiträge zur klinischen Chirurgie*, Band xxix, Heft 2.

III. Operative Treatment of Irreducible Shoulder Dislocations. By DR. E. SCHOCH (Münsterlingen). Obstacles to reduction, long familiar to us, alone constitute the indications for operative interference. They are the interposition of the original capsule or one of new formation in older dislocations, fractures of the upper end of the humerus, fracture of the glenoid cavity, interposition of muscles and tendons. The very portion of the capsule (coraco-humeral ligament), which affords us a fulcrum to exert the leverage in reduction, may, if the latter fail, be subsequently

all-powerful in retaining the head at its new site by virtue of its shrinkage. From this starting-point the sclerotic process may involve the entire capsule; this being still further complicated by new ossification if the articular ends of the humerus be fractured. Thus a new cavity is formed, the old one becomes atrophic, and the picture is completed by adhesions with the surrounding muscles and their atrophy. The index as to what constitutes an old irreducible dislocation should not so much depend on the time lapsed as the conditions found, even if they be as enumerated above, after the expiration of a few weeks. Muscles and tendons are by their dislocations seldom responsible for irreducibility, but more commonly their adhesions with misplaced bones.

Left to itself, an old dislocation may with practice even out-class functionally the best operative results. Where the prospects of this are not in sight, arthrotomy or resection is indicated. In recent instances mere arthrotomy offered good functional results in 83 per cent., but in older cases with a showing of 64 per cent. against the 51 per cent. obtained by resection. Arthrotomy to be the first choice is determined by the ability to replace the head, if it be not too severely altered and the glenoid cavity maintained. If the converse obtains, resection is better than the possibility of eventual ankylosis. Of course, rigid asepsis is a *sine qua non*.—*Beiträge zur klinischen Chirurgie*, Band xxix, Heft i.

MARTIN W. WARE (New York).

IV. Hæmarthros of the Knee. By DR. C. LAUENSTEIN (Hamburg). Lauenstein briefly reviews the various means adopted in the treatment of knee hæmarthros. His own practice is to evacuate the blood and immobilize the joint for several weeks. Only after the capsular rent is probably healed does he permit the patient to get up and begin active movements. In cases where the hæmarthros is complicated by fracture of bone (patella, condyles), the blood is evacuated before dressings are applied. Where the indications call for open suture of the patella, the operation is always preceded by complete evacuation of the bloody effusion.

Rapid evacuation of the effusion permits the tissues to resume their normal anatomical relations. Capsular rents heal better if their edges approximate each other as nearly as possible. After drawing off the blood, the author always introduces a probe through the cannula, and by this means is often able to locate the capsular rent, as at this place the end of the probe can be felt directly under the skin. When a tear in the capsule is demonstrated, ambulatory treatment and early motion must be absolutely tabooed.—*Centralblatt für Chirurgie*, 1901, No. 6.

V. Restoration of Function in Ankylosed Joints. DR. V. CHLUMSKY (Würzburg) finds that the treatment of uncomplicated contractures and joint ankyloses meets with but moderate success as regards restoration of function. Of fourteen cases of non-tubercular contractures and ankyloses of the knee-joint, occurring in the Breslau Surgical Clinic and collected by the author, there was not one in which any considerable improvement of mobility could be stated. These cases were people who were extremely anxious that an approximately normal condition of the joint be brought about. Search through the literature failed to reveal better results, so the author has endeavored to throw some light upon the subject from an experimental stand-point. These experiments are based upon the fact that restoration of movement in a joint partly or completely obliterated is obtained by simple means in individual cases, and that this will at times occur in spite of our utmost effort at prevention, as in pseudarthroses. For these very reasons complete restitutions of movement must be possible.

Ankyloses and contractures are of three varieties, consisting (1) in an atrophy of the soft parts; (2) in a union either fibrous or bony between the joint surfaces; most frequently (3) in a combination of the above conditions. In the case of atrophy of the soft parts, we are able to restore function, or at least improve the mobility of the joint, by means of massage,—active,

passive, and resisting movements; finally, by sharp force. It is almost impossible, however, without operation to permanently loosen bony or fibrous ankyloses. Results gained by force will soon be annulled by the formation of fresh attachments. In fact, the condition of the patient, without taking into account the amount of pain he has gone through, is frequently made worse. A like experience is manifested in case of open separation of these attachments unless it is possible to prevent their reformation. The path to the successful treatment of this class of cases is shown us in the study of the formation of pseudarthroses. These are due, in addition to single cases of callous formation, to the interposition of the soft parts between the two bony surfaces, thus preventing their apposition and consequent union. By imitating the above, it becomes probable that we can restore function to previously useless and ankylosed joints. Some operators have followed out Verneuil's proposal in cases of ankylosis of the temporomaxillary articulation, the resection of the head of the mandible and placing in the resulting gap small pieces of the neighboring muscles. Von Mikulicz uses the fibres of the masseters for this purpose. Helferich, Lenz, and Riegner report satisfactory results in these cases.

In case of the larger joints this mode of procedure is not practical, in the first place, because the interposed muscle or tissue may be fatal to the later function of the joint, and, secondly, on account of the greater difficulties in carrying out the technique. The author, consequently, endeavored to produce a good result by the introduction of foreign bodies of materials. With this in view, the knee-joints of dogs and rabbits were resected, and small plates of celluloid, silver, tin, rubber, or Billroth-batist were introduced between the bone surfaces, or a layer of collo was used. These experiments were made in part in the Surgical Clinic of the Royal University at Breslau and in part in the laboratory of the Pharmacologic Institute at Würzburg. The operative procedure was as follows: The animal was narcotized with morphine-ether or with ether. The skin surrounding the knee-joint

was cleansed and disinfected. The joint was opened by a flap incision generally made below the patella, sometimes above it. All the ligaments, including the crucial, were divided, and the bones partially or completely resected. The fresh surface of the tibia was then covered completely with one of the plates mentioned above. This plate was held in the place by silk sutures. The plates employed were one-tenth to eight-tenths millimetre in thickness, triangular, with rounded edges and corners. In case of the thicker plates the apertures for suture were previously established. Finally, the lateral ligaments, the patella ligament, the capsule, and the skin were sutured. The skin suture line was protected by a dressing of iodoform collodion. When the removal of bone had been extensive, the ligaments, as well as the capsule, were shortened by suturing so as to avoid undue laxity of the joint. Where simple shaving of the cartilaginous surface had been performed, the ligaments were sutured exactly. For the first few experiments regular dressings were employed, but experience soon showed that these were either speedily torn off or became soiled. Plaster-of-Paris bandages were used for fixation, but the animals did not tolerate them at all. Some tore them off, others became emaciated.

Formation of cartilage as well as the rounding off of the ends of the bones was quite analogous to the results obtained in the former experiments. The author is of the impression, however, that the resulting joint cavity was smaller in the majority of cases than were those of the former series. He therefore is unable to state, owing to the short period of observation, whether the cavity would still further diminish in size, and thus interfere with a good result finally. It may be that the plates employed were too thin. Chlumsky is still working along these lines, and promises a more complete report at a future date. The result obtained thus far seems to hold out hopes for a class of cases which heretofore have been most difficult of successful treatment.—*Centralblatt für Chirurgie*, 1900, xxxvii, 921-925.

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REVIEWS OF BOOKS.

PROGRESSIVE MEDICINE. Vol. I. March, 1901. Philadelphia: Lea Brothers & Co., 1901.

This first volume of the century is rich in surgical references. The surgery of the head, neck, and chest is brought up to date by Dr. J. Chalmers Da Costa. The surgery of goitre and exophthalmic goitre is briefly summed up. The author gives Gordon's views of Graves's disease, which are based largely upon the assumption that hyperthyroidization is not the cause of the disease, but that irritation of the sympathetic nerve is the real cause.

Some day this work will give less space to caustic pastes for the treatment of epithelioma: this volume, however, gives the unsurgical a pretty considerable amount of encouragement with formulæ for the application of this sort of treatment.

Here is some good surgery from the pen of Dowd: "The imperative necessity for removing the glands anatomically related to carcinoma, as well as extirpating the growth, is generally recognized by surgeons when operating for cancer of the mammary gland. Strange to say, it is often lost sight of or disregarded in operating for cancer of the lip; and yet it is as positively required in the latter case as in the former."

There is an interesting discussion on rhinoplastic operations. The same with temporomaxillary ankylosis, in which Grieg is quoted as saying that the only operation worth considering is resection of the condyle of the lower jaw.

The up-to-date treatment of cleft palate is discussed, and the operation of lifting up a flap from the side of the mouth and near the base of the tongue is reviewed, together with Ferguson's new operation.

In the discussion of the modern and radical treatment of tuberculosis of the neck lymphatics, Cheyne is quoted to the effect that in nearly every case of involvement of the deep lymphatics with caseation or suppuration he removes the segment of the deep jugular vein which is adherent. The ubiquitous small-bore modern bullet wound is not neglected; and the Surgeon-General's last report comes in for a fair share of notice.

There is a full discussion of Walter C. Wood's valuable paper on the surgical treatment of pulmonary tuberculosis. The treatment of wounds of the heart is discussed in the light of the most recent experiences. The author says that we have passed beyond the point of view of Billroth, who said that no surgeon who wished to preserve the respect of his colleagues would ever attempt to suture a wound of the heart. Even this great man was able to see but dimly into the future of surgical possibilities.

Rodman's observations on cancer of the breast are well selected. Interest in the surgery of epilepsy is given a new impetus by Jonnesco's operation of removal of the cervical sympathetic ganglia.

The chapter on pathology, edited by Ludvig Hektoen, is so full of interest that it may be read by surgeon and physician. Few biological problems are of greater importance than those of immunity, which are here discussed. Cytotoxins and anticytotoxins, hæmolysins, epitheliolysin, nephrolytic serum, spermotoxins, leucocytolysins, cytolysis,—these are some of the subjects discussed, subjects which have passed through the period of vagueness and experimentalism, and are now matters which confront us with their real and important presence.

JAMES P. WARBASSE.

A CONTRIBUTION TO THE PATHOLOGY OF THE SPHINCTERS.

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IN trying to comprehend the pathological conditions under which the bladder and rectum perform their functions in certain injuries and diseases, I have encountered great difficulty. An examination of various text-books upon medicine and surgery shed no light upon the subject, but rather added to the trouble, as conflicting statements were made without any adequate explanation being offered. During the exercise of the office of Surgical Registrar at St. Thomas's Hospital, I had abundant material for observation on these points, and I take this opportunity of conveying my thanks to the staff for the use of their cases. After observing over 100 cases, the conclusion was reached that the frequency with which the sphincters were affected did not depend so much on the number of cases examined as on the chance amount of violence causing the injury. As the figures are valueless in indicating the frequency of such affections, no further observations were included, there being sufficient evidence in hand to testify to the existence of the different pathological states to be referred to. The figures themselves clearly show that the main cause is the amount of violence, as in concussion of the brain the affection of the sphincters is infrequent, whilst in fractures of the skull, etc., they become more frequently affected.

In the minds of students and writers of text-books the mystery of the sphincters is made worse by the confusion that exists as to the meaning of the word "incontinence."

It is generally understood to mean the unconscious passage of excreta, whether by a reflex act or otherwise. As the normal passage of excreta is a reflex act allowed and sometimes aided by the higher centres, it would seem better to restrict the name incontinence to the abnormal; *i.e.*, to the passage of excreta other than by a reflex act; and in this definite and restricted sense the word incontinence is used throughout this paper. The various methods of passing urine are therefore by conscious micturition, unconscious micturition—*i.e.*, by an unconscious reflex act, and incontinence. Precisely similar varieties of defecation also exist.

In this paper the effects of various lesions upon the excretion or secretion of urine have not been dwelt on, and carcinoma of rectum, etc., have been carefully eliminated. Unlike the bladder, the rectum may contain both solid and liquid excreta; but, as the solid or semi-solid motions are the natural contents, they alone are considered. The results of the presence of irritating fluids in the rectum will be obvious.

The two chief conditions under which the bladder and rectum are found are the paralytic and the non-paralytic. Under each of these states differences will be found, and will be fully considered now before going on to the consideration of the different diseases and injuries. Each of these organs may be regarded physiologically to consist of a body, the detrusor, and a sphincter.

THE NON-PARALYTIC STATE.

This state is present in concussion, lesions of the cord above the lumbar centre, and so forth. The possibilities will be considered with regard to the *bladder* first.

(1) A reflex act of unconscious micturition may take place, the bladder expelling its contents. Gowers has termed this "intermittent incontinence."

(2) If for any reason such a reflex act does not occur, the bladder will become further distended, and soon lose its power of contracting to cause the passage of urine, such condition being termed retention of urine.

(3) If the retention of urine is unrelieved, the bladder will continue to be filled with urine until the pressure within is sufficient to overcome both the mechanical and muscular, or the physical and physiological, or the passive and active resistances of the urethra, and then the urine will overflow.

Of this overflow two varieties exist. The bladder normally undergoes rhythmic contractions, which only disappear with very great distention. These contractions will cause the passage of a few drops of urine every few minutes, and can be clinically recognized. This condition is best termed active overflow.

If the bladder becomes still further distended, these rhythmic contractions cease, the muscular wall becoming paralyzed. The urethra being canalized, the overflow will consist of drops of urine being mechanically displaced from the bladder by influx from the ureters, and can be recognized clinically by the presence of a more or less continuous dribbling. This state may be called passive overflow.

In recognizing it clinically, one must be careful to eliminate the action of the diaphragm, which makes it appear more intermittent than it really is.

Neither condition of overflow should be seen clinically, as the retention should be relieved by a catheter. If by any means the passage of a catheter is delayed, active overflow will first be seen and later passive overflow. Naturally, the latter phenomenon is of rare occurrence.

The Rectum.—The rectum differs from the bladder in several important points, of which the following may be cited: its normally solid contents; its tolerance of those contents, sometimes very great; its evacuation once a day, as compared with the bladder's four or five times daily, etc. Observations on the rectum are not so easily made, as a purge is usually administered, which masks the condition present. The conditions will be very similar to those of the bladder, and are,—

(1) Reflex act of defecation, unconscious defecation.

(2) If the above fails to occur, there will be retention of faeces, most probably followed by constipation.

As the rectum and sigmoid are capable of almost infinite distention, and the contents are solid, no such condition as overflow is observed. With liquid fæces active overflow is seen, but passive overflow was never observed.

The "retentions" noted in the non-paralytic state have opposed to the efflux active physiological resistances, *i.e.*, muscular, and may be called active retentions.

THE PARALYTIC STATE.

In this condition a similar state of affairs can be traced.

The Bladder.—When the bladder is paralyzed, it might be expected that the urine would trickle from the ureters through the bladder and out of the urethra, the musculature of the sphincter of the bladder and urethra also being paralyzed. Gowers has given the name of simple incontinence to this condition. Such a state is, however, more ideal than real. The urethra is not an open pipe, but its walls are in apposition; therefore the urine has to collect in the paralyzed bladder until the pressure is sufficient to overcome the passive, physical, or mechanical resistance of the urethra. The amount of the obstruction varies considerably, and is least in the short urethrae of women, in whom the ideal simple incontinence of Gowers is most nearly approached. In a man there is superimposed the resistance of a longer urethra and the prostate. The presence of an obstruction, stricture, etc., will also increase the passive resistance to be overcome.

At first a certain degree of retention will be present, to be followed by a purely passive paralytic overflow, which differs from the non-paralytic passive overflow in that in the latter both the active and passive resistances of the urethra have to be overcome, whilst in the former the passive only. Consequently in the paralytic state the vesical distention required to cause overflow is less than in the non-paralytic.

In speaking of the paralytic bladder, it has been assumed that the normal rhythmic contractions are absent. As the mechanism which causes these has been assumed by physiologists to be purely local, they may even be present in the para-

lytic state and help the organ to overcome the resistance of the urethra. Whether such a condition exists it is impossible to say, but, eliminating the action of the diaphragm, there may be theoretically an active followed by a passive overflow in the paralytic as in the non-paralytic state.

The Rectum.—The rectum itself is not paralyzed, as peristalsis is handed on from segment to segment of the bowel either by continuity or by a local nervous mechanism. Therefore, in paralytic states it is merely necessary to deal with paralysis of the sphincter.

(1) Incontinence of fæces is to be expected on account of the paralysis of the sphincter.

(2) But owing to the solidity of the contents, the tolerance of the rectum and sigmoid, etc., the patient usually suffers from retention of fæces and constipation, *i.e.*, passive retention.

If by chance the fæces are liquid, incontinence of fæces will be present, not in the gushes of a reflex act, but in dribbles due to the peristalsis, an active overflow.

The persistence of contraction in the rectum in spite of paralysis emphasizes the point made above, *viz.*, that similar contractions may be present in the bladder, due to its continuity with the ureters, so causing not passive but active overflow.

Professor Sherrington (*Journal of Physiology*, xiii, p. 578) points out that Mosso and Pellacani were the first to demonstrate the rhythmical contractions and relaxations of the bladder. He also showed that in the monkey cross-section of the spinal cord at the level of the twelfth dorsal nerve stopped the muscular contractions of the bladder for two minutes only. The problem of active overflow from the paralytic bladder seems founded upon a fair experimental basis.

The "retentions" in the paralytic state are only due to the passive, mechanical resistance of the urethra to be overcome by the intravesical pressure, and are therefore passive retentions in contradistinction to the active retentions of the non-paralytic state, which have to overcome both active and passive resistances.

TABLE I.

I. BLADDER.

- Non-paralytic state. 1. Reflex act, unconscious micturition.
 2. Active retention.
 3. Active overflow.
 4. Passive overflow.

The obstruction to the overflow consists of the active and passive resistances of the urethra.

- Paralytic state. 1. Passive retention.
 2. Active overflow.
 3. Passive overflow.

The resistance to the overflow consists only of the passive urethral factor.

2. RECTUM.

- Non-paralytic state. 1. Reflex act, unconscious defecation.
 2. Active retention of fæces and constipation.
 Paralytic state. 1. Incontinence of fæces.
 2. Passive retention of fæces and constipation.

The active and passive retentions are brought about by the non-paralytic or paralytic states of the sphincter ani.

CONCUSSION OF THE BRAIN.

Concussion is a condition in which the symptoms are most severe at the time of the receipt of the injury, and thence progress favorably. The severity of the symptoms depends upon the degree of concussion. For instance, in mild cases there may be only slight symptoms of short duration, and in severe cases they are more marked and prolonged. The cases from which the figures are taken are those in which the concussion was severe enough to demand admission to St. Thomas's Hospital. In arranging these in groups according to the condition of the sphincters, it is most convenient to start with those of the milder degree.

In far the greater number of cases the sphincters were unaffected, as was the case with fifty-four out of seventy cases of concussion; in others reflex acts of unconscious micturition and defecation occur.

Bladder.—(1) In the more severe cases of concussion the lumbar centre, in common with the other reflex centres, remains dulled in its excitability, and consequently requires

afferent impulses from the bladder stronger than normal to excite a reflex act. The bladder consequently fills up and a condition of active retention of urine is present.

This retention must be carefully distinguished from diminished secretion. For instance, a boy, aged eleven years, only secreted six ounces of urine during the first twenty-four hours. Polyuria occasionally follows head injuries, and will accentuate the condition of the bladder.

Retention of urine is the commonest affection of the bladder, occurring in sixteen out of seventy cases of concussion.

(2) If unrelieved, the retention of concussion may proceed to active and, perhaps later, passive overflow of urine. As the number of cases of retention allowed to proceed to incontinence is not important, it is useless to give figures.

(3) The retention may remain absolute, especially if there is some grosser obstruction in the prostate or urethra.

The pathological condition of the sphincter depends on the degree of concussion, and, secondarily, upon the time, when the case is examined, after the injury.

Rectum.—The rectum, as the bladder, is most frequently not affected, but in severer cases active retention of faeces followed by constipation will be the rule. The dull condition of the reflex centre is shown by the difficulty experienced in getting the bowels to act.

Failure of a rectal or vesical reflex taking place may be due in part, also, to the fact that in concussion, as in other injuries, the impulse from the higher centres that sanctions the reflex does not arrive, and the act is in consequence delayed.

TABLE II.

CONCUSSION.

The results of this injury may be tabulated as follows and in order of their frequency.

- Bladder. 1. Reflex or unconscious micturition.
2. Active retention.
 (a) active overflow.
 (b) passive overflow.
 (c) absolute retention.

- Rectum. 1. Reflex or unconscious defecation.
2. Active retention and constipation.

FRACTURES OF THE SKULL.

Broadly speaking, fractures of the skull present in their general symptoms the signs of concussion, compression being excluded, and the diagnosis of contusion or laceration of the brain uncertain. They are also usually due to more severe violence, and consequently show the more severe signs of concussion, though fractures of the skull do occur occasionally without any constitutional signs.

Only sixteen out of seventy cases of concussion showed any affections of the sphincters, whilst eight out of thirteen showed them in fractures of the base of the skull. Whether this is due to some slight degree of compression, it is impossible to affirm or deny. Of the eight cases, all were active retentions of urine, four being allowed to proceed to incontinence; whether of the active or passive variety is unimportant, as the latter is but a farther degree to which the former may or may not be allowed to proceed.

It is very interesting to note that out of three women with fractured bases, two showed incontinence of urine, doubtless due to the slight resistance of their urethræ only needing slight increase of intravesical pressure to yield overflow when the higher centres are dulled in sensibility.

With regard to the rectum, active retention of fæces and constipation were the rule. One man, aged forty, had expulsion of fæces by means of a reflex act, *i.e.*, unconscious defecation.

Of fractures of the vault of the skull, nine in number, two patients showed no sign of concussion, two died of compression, and of one there is only a deficient record. Of the five remaining, two suffered from active retention of urine going on to incontinence.

The only woman admitted also suffered from incontinence of urine. With these cases, three out of five showed affection of the sphincters.

In those cases in which the rectum was affected, active retention of fæces followed by constipation was the rule. An exception was a man, aged forty-five, who passed his fæces by a reflex act unconsciously—unconscious defecation.

COMPRESSION.

The symptoms differ from those of concussion in that they get progressively more severe if allowed to take their course. Data concerning the sphincters are far more difficult to obtain, as the patients may die before sufficient amount of urine or fæces has had time to collect, or operation may relieve the symptoms. The condition will also depend upon the duration of the compression when observations are taken.

In compression, a paralytic state of affairs exists in the later stages, and apparently this affects the bladder.

(1) In the early stages of compression, or the preliminary concussion, urine may be voided by a reflex act, or even semiconsciously, *i.e.*, the preparalytic state.

(2) Possibly, and rather probably, active retention of urine will have occurred during the preliminary concussion, etc., which in compression passes on to the passive retention of paralysis.

(3) When the symptoms of compression are marked, paralytic overflow takes place. I cannot say whether this is of an active or passive variety, but rather incline to the former. The bladder is always distended to some extent, and it is not the ideal "simple incontinence" of Gowers. The filling up of the bladder has given rise to Mr. Dean's statement, in his article in Treves' "Surgery," Vol. ii, that in compression the bladder is distended and overflows. If the prostate and urethra are healthy, the distention is not so great as that required to cause overflow in the non-paralytic state, as only the passive resistance of the urethra has to be overcome. In such cases the rule seems to be passive retention, passive paralytic overflow, probably active, and rarely passive.

How far the paralysis of compression affects the bladder,

it is not possible to state; but it can be said that it is the sphincter that is chiefly, if not alone, affected.

With regard to the difference of sex, nothing can be said from actual observation; but it is to be expected that women, as is the case elsewhere, will more easily suffer from overflow of urine, owing to their short, distensible urethræ.

As with the sphincter of the bladder, the sphincter ani is paralyzed. As there is no passive resistance to be overcome and the consistence of the fæces allows it, incontinence of fæces would happen. But the preliminary concussion, etc., of compression may have caused active retention of fæces followed by constipation. The fæces then will probably not allow the peristalsis to evacuate them, and further retention and constipation result, *i.e.*, passive retention.

TABLE III.

COMPRESSION.

Bladder.	1. Passive retention.
	2. Active paralytic overflow.
	3. Passive paralytic overflow (?).
Rectum.	1. Incontinence of fæces.
	2. Passive retention of fæces and constipation.

SPINAL INJURIES.

Spinal injuries may be divided with regard to the sphincters into two regions; (*a*) supralumbar, above the centres in the cord; (*b*) lumbar, involving these centres.

Supralumbar.—There are various stages in the conditions of sphincters which can be seen as the patient recovers.

(1) Owing to the dulling of the excitability of the lumbar centres due to some hæmorrhage, concussion, etc., active retention of urine is the rule, which is of the non-paralytic kind, and, if unrelieved, will proceed to absolute retention, active overflow, or perhaps still further to passive overflow.

(2) A variable time after the accident, the lumbar centre recovers its tone, and micturition occurs reflexly, the bladder periodically emptying itself.

(3) Later still, the centre becomes hypersensitive, and

micturition, like other reflex acts, becomes exaggerated, the bladder expelling its contents at shorter intervals than in the second period.

The rectum is affected similarly to the bladder, but differs in its solid contents, tolerance to the same, etc. Hence, during the stage of active retention of urine, active retention of fæces and constipation will exist. Later, a reflex expulsion of fæces may occur, and this act may become more frequent and the reflex exaggerated.

Lumbar.—When the lesion is nuclear and involves the lumbar centre, then the typical paralytic condition described under compression exists for both bladder and rectum.

TABLE IV.

SPINAL INJURIES.

a. Supralumbar lesions.

- | | |
|----------|--|
| Bladder. | 1. Active retention and its possible sequels. |
| | 2. Reflex micturition. |
| | 3. Exaggerated reflex micturition. |
| Rectum. | 1. Active retention of fæces and constipation. |
| | 2. Reflex defecation. |
| | 3. Exaggerated reflex defecation. |

b. Lumbar lesions. Same as Table III.

- | | |
|----------|--|
| Bladder. | 1. Passive retention and its possible sequels. |
| | 2. Active paralytic overflow. |
| | 3. Passive paralytic overflow. |
| Rectum. | 1. Incontinence of fæces. |
| | 2. Passive retention of fæces. |

LESIONS OF NERVES.

The effect of nerve lesions upon the sphincters has never been brought to the notice of clinical observers, and it is to do this that I append the following brief descriptions.

Bladder.—Professor Sherrington confirmed previous observers as to the double nerve supply to the bladder, one from the lumbar and one from the sacral nerves. The latter produces the more powerful contractions of the bladder. Langley and Anderson (*Journal of Physiology*, xix, p. 73) confirmed Sherrington, and added that stimulation of the lumbar

nerves gives rise to contraction of the bladder insufficient to produce micturition. Former observers had adapted von Basch's theory of double innervation to the bladder, and had given one set of nerves, the lumbar, to govern contractions of the muscular coat, and the other, the sacral, to affect the circular coat. Both the above authors and Dr. Griffiths (*Journal of Anatomy and Physiology*, xxv, 1891) failed to confirm this, stating that on stimulation of either set of nerves the whole musculature of the viscus contracted.

The above authors were concerned with the contraction of the body of the viscus and not the action of the sphincter vesicæ. The action of the latter was excluded by the method of recording the contractions of the bladder, by the movements of a column of fluid connected with the bladder by means of a catheter. It is consequently not so easy to obtain light upon the action of the nerves on the sphincter vesicæ. Langley and Anderson, also Sherrington, point out that stimulation of the lumbar nerves causes contractions of the body of the bladder, and especially the parts of the base, *i.e.*, the sphincter round the catheter (?). Thane, in Quain's "Anatomy," Vol. iii, part 2, quotes Dr. Head for showing that the upper nerve supply is responsible for "feeble contraction and over-distention." It seems therefore probable that the upper (lumbar) nerve supply, when stimulated, causes a weak general contraction of the body of the viscus with a strong contraction of the sphincter, hence the "over-distention" (Head), and failure of stimulation of these nerves to produce micturition (Langley and Anderson). Stimulation of the lower set of nerves, sacral, causes stronger contraction of the body of the bladder and micturition, *i.e.*, relaxation of the sphincter vesicæ.

From the above it is possible that in some clinical cases, such as tumors, caries, etc., each set of nerves may be involved separately.

(1) In paralysis of the upper set (dorsal, 11 and 12, lumbar, 1, in man, Thane, *loc. cit.*), there will be paralysis of the sphincter vesicæ, leading to a purely passive retention

of urine (which will later be discharged in small gushes, as only the passive urethral resistance is encountered), active paralytic overflow, and later still possibly passive paralytic overflow.

(2) In paralysis of the lower set (2, 3, 4 sacral in man, Thane, *loc. cit.*), there will be paralysis of the body of the bladder, leading to retention of urine, of an active kind, which will remain absolute or result in an overflow, active (?) or passive.

The Rectum.—The rectum has a double nerve supply like that of the bladder. Professor Sherrington (*loc. cit.*, p. 672) studied the action of these nerves upon the anus alone, *i.e.*, the sphincter. Stimulation of the upper set caused contraction of the sphincter and of the lower set relaxation, thus agreeing with what has been said of the action of the sets of nerves upon the sphincter of the bladder. Langley and Anderson (*Journal of Physiology*, xviii, p. 104) exhaustively examined the innervation of the lower part of the intestine, *i.e.*, what corresponds to the body of the bladder. They found that stimulation of the lumbar set of nerves caused a doubtful dilatation of the rectum and colon, whilst that of the sacral nerves caused powerful contraction, in which they included the sphincter ani. The double nerve supply of the rectum is precisely analogous to that of the bladder, except that the sphincter ani can be contracted with the bowel by the upper set of nerves and without it by the lumbar.

Von Basch's theory of double innervation of the longitudinal and circular muscular coats is therefore possibly untrue for the bowel as it has been shown untrue for the bladder.

If pathologically the sets of nerves were paralyzed independently of each other, the following conditions would appear:

(1) Paralysis of upper set of nerves (lumbar, exact nerves unknown) will cause paralysis of the sphincter and incontinence of fæces, provided that the latter are of a consistency allowing of expulsion, otherwise there will be constipation.

(2) Paralysis of the lower set (sacral, precise nerves unknown) will cause paralysis of the gut, leaving the sphincter contracted. Hence there will be an active retention of faeces and constipation.

The results of lesions of these two sets of nerves may be briefly stated together, as the nerves are probably the same or thereabouts.

TABLE V.

- | | |
|--------------------------------|---|
| 1. Paralysis of the upper set. | Active incontinence of urine.
Incontinence of faeces (perhaps constipation, clinically). |
| 2. Paralysis of the lower set. | Active retention of urine.
Active retention of faeces and constipation. |

Before concluding, I wish to point out one or two results other than those in the various tables.

It is desired that the different results of retention in the male and the female should be understood, and so possible misunderstandings avoided. In both the paralytic and the non-paralytic states the female is far more prone to incontinence of urine, apart from her immunity to stricture, etc., owing to her short urethra.

It will also be noticed that there is a nearly perfect sequence of states from that resulting from slight concussion to the paralytic condition of marked compression. And as the higher or severer grades in this series are reached, there seems to be a greater tendency for the retentions of urine to become more easily incontinenes, indicating that the greater the violence or concussion the greater is the tendency to some paralysis of the sphincter, and the active retention to become a passive retention.

Further, it will be noticed that I have introduced new terms, if not new ideas, in some cases. The distinction between active and passive retention is, that in the former the sphincter is active and in the latter it is passive or paralyzed. Similarly, the active overflow is due to the spontaneous and rhythmic contractions of the bladder; passive overflow being

the purely mechanical result of distention producing overflow. This over-distention of paralysis can occur in active retention of urine, *i.e.*, non-paralytic state, but in paralytic retention the bladder will probably not become sufficiently distended for it to be paralyzed. Thus, in the paralytic condition, it is most probable that the rhythmic contractions of the bladder persist, so that only active paralytic overflow is to be expected.

No mention of the sphincters in medical diseases has been made, as it has not been my lot to see such cases. Therefore I have abstained, but the states for the different medical lesions are perfectly obvious from the remarks made.

Finally, it would be well to have a clear understanding of the words used to denote states of the bladder, etc. Normally, urine is passed by means of a reflex act sanctioned by the higher centres, and to which I would suggest the name normal or conscious micturition. When the reflex act occurs without regard for the higher centres, the name of unconscious micturition may be retained. The word incontinence is used for expulsion of excreta other than by a reflex act, and can be resolved into overflows, paralytic or otherwise, active or passive, which carry with their names distinct meanings. The name incontinence has in consequence only been retained for the passage of *fæces*, *i.e.*, solids which cannot overflow. And yet again there cannot be an "incontinence" or overflow of urine without a previous retention. The name overflow indicates this, and will therefore be preferable to "incontinence."

MILTON'S METHOD OF EXPOSING THE ANTE-
RIOR MEDIASTINUM MODIFIED FOR LIGA-
TURE OF THE INNOMINATE ARTERY.

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THE methods in use for reaching the anterior mediastinum may be divided into trephining, resection of the edges of the bone and of the adjoining costal cartilages, osteoplastic resection, and splitting the sternum (suggested by Milton).

Trephining of the sternum is an operation at least as old as Galen's time, but the openings so made are too small for any other purpose than simple drainage of an abscess, and the method does not need further consideration here.

Removal of a portion of the margin of the bone and more or less of the adjoining costal cartilages, especially the partial resection of the manubrium to enlarge the field for operations at the root of the neck, is much more useful than trephining. It has been employed thus by von Bruns, Kocher, Burrell, and Cooper (of San Francisco). Cooper was probably the earliest of these surgeons, and he used the method in applying a ligature to the innominate artery, as did Burrell also.

In 1886, Bardenheuer recommended osteoplastic resection of the manubrium, detaching a portion of the bone but leaving this part in contact with the soft parts, so that it could be thrown back like a trap-door. His method is briefly as follows: A transverse incision is made along the jugulum, extending over the internal third of each clavicle, and a vertical incision is carried downward from the former in the median

line of the sternum. In the upper incision the fascia and muscles are detached from the bones and the periosteum is then peeled from the posterior surface of the manubrium, of the clavicles, and of the first ribs. A small portion of the left clavicle and left first rib may be resected subperiosteally in order to gain freer access to the posterior surface of the manubrium. The manubrium is divided transversely about an inch below its upper border, and the right clavicle and first and second ribs are divided, and the detached bone can then be turned out towards the right, the soft parts acting as a hinge. He has employed this method in ligation of the innominate artery and vein, and ligation of the first part of the subclavian, and in operations for tumors.

Giordano recommends division of the costal cartilages of two or three ribs on the right of the sternum at any chosen point, detachment of the pleura by the finger, division of the sternum transversely at the lower and upper limit of this detached portion, the skin incisions corresponding to these lines of division of bone and cartilage. The bone-flap is then pried up so that the fingers can be pushed beneath it to detach the pleura on the left side, and by continuing the lifting of the flap the corresponding costosternal articulations on the left side will yield, and the bony trap-door can be thrown over to the left, exposing the mediastinum at any desired point. He claims to have completed this preliminary operation on the cadaver in five minutes, but I know of no one who has tried the method on the living subject.

Willy Meyer in one case divided the sternum transversely at the level of the first intercostal space by a simple incision with chiselling of the bone, and by dragging the upper fragment forcibly upward was able to expose and partly remove a dermoid tumor from the anterior mediastinum.

These methods are all useful, but the suggestion of Milton, in 1897, to expose the mediastinum by a simple longitudinal division of the sternum appears to have great advantages. The technique is simple, sufficient space is obtained for the most frequently required operations upon those parts, and the

solidity of the chest is restored completely afterwards. Osteoplastic flaps are difficult to make and often suffer in their circulation so as to result in partial necrosis, or at least an impairment of vitality which renders them peculiarly subject to infection.

In January, 1900, I presented to the New York Surgical Society a man upon whom I had employed a modification of Milton's method as a preliminary operation to ligation of the innominate artery. I split the manubrium only, and then divided the bone transversely at the lower border of the first intercostal space. As the first report (*ANNALS OF SURGERY*, xxxi, p. 629) was incomplete, I will briefly give the history of the case.

M. A., fifty-five years of age, a carpenter by trade, single, born in Sweden, was admitted to St. Luke's Hospital in November, 1899, with a complaint of having had intense pain in the right arm, interfering with his use of the limb for some months. Examination revealed a hypertrophied heart with a double murmur over the aortic valve and a systolic murmur at the apex. All the arteries were enlarged and hard, especially the right subclavian and axillary. Under the right clavicle was a swelling apparently two inches in diameter, corresponding to the subclavian artery, having a true expansile pulsation with the heart's systole, and a loud systolic bruit. Deep pressure upon the first part of the subclavian arrested the pulsation. The right axillary artery was as large as a man's thumb as far down as the border of the latissimus dorsi. The carotids were but little altered, and there was no increased pulsation of the first part of the right subclavian.

Rest in bed for two weeks, and heavy doses of potassium iodide with limitation of diet and fluids, much improved the condition of the arteries and moderated the action of the heart. The iodide was discontinued a week before the operation, but the pulsation of the arteries did not increase.

December 2, 1899, assisted by Dr. Francis H. Markoe, under ether anæsthesia, I operated by splitting the manubrium sterni in the middle line, dividing the bone transversely just above the second rib. (For details, see description below.) The two halves

could then be separated nearly two inches. A large artery was exposed, and, supposing it to be the innominate, I passed a ligature around it. Pressing with the finger in the loop of the ligature, pulsation was arrested in the carotid but not in the aneurism, proving that the vessel was the immensely dilated carotid; so it was released. The first part of the subclavian was found, and was seen to be as large as the former vessel, each measuring fully an inch in diameter. The vessels were followed downward, and the innominate discovered to be between one and a quarter and one and a half inches in diameter, but its walls appeared healthy. The innominate was isolated, and a double heavy chromicized catgut ligature was passed around it by means of a strong pedicle needle shaped like an iliac aneurism needle. Pressure upon the vessel in the loop controlled both the carotid and subclavian circulations. The two threads were laid side by side so as to make flat pressure, but were tied simultaneously, and not according to Ballance and Edmunds's directions, for the artery was so large and tense that it was feared the catgut would break if tied singly. While tying the knot the artery was folded in on itself smoothly by the pressure of a blunt instrument in the loop, so as to avoid crumpling up the wall, and the knot was drawn only tight enough to arrest pulsation and not so as to cut the internal coat. This ligature was placed about three-quarters of an inch below the bifurcation. A single ligature of catgut of the same size was passed through the same opening beneath the artery, but tied obliquely, so that in front it lay about a quarter of an inch distally from the first. This ligature was pulled a little tighter than the first, but not so as to cut the inner coat. It had been intended to slip this ligature along the artery farther from the first, but this intention was abandoned for fear of causing too great separation of the vessel from its sheath. The view of the vessels was perfect and the dissection easy. The pleura and the innominate vein were easily pushed aside unharmed, and no nerves or other large veins were in the way. Ligatures were applied to two or three veins passing upward towards the thyroid gland. After the vessels had been secured the bone was allowed to return to its position, and the two halves united with a couple of silver-wire sutures. The wound was closed without drainage, except at the lower angle between the skin and the sternum, where

a small gauze drain was inserted because of the rather abundant oozing from the divided bone.

Recovery was marked by rather disquieting symptoms, a temperature of 104° to 102° F. for two days, a leucocytosis of 19,800 (6200 before operation), great restlessness, and much pain in the shoulder. The pulse was relatively slow (106 to 118) and of good quality, and there were no cerebral symptoms; the wound healed well, except that it became somewhat red at the upper angle, with a drop of pus around some of the skin sutures. On removal of these sutures, solid uninfected blood-clot was seen just below the gaping skin. The temperature still ran somewhat over 100° F., although the leucocyte count had returned to normal. The patient was kept very quiet and considerable morphine administered, and, probably as a result of the latter, the bowels did not move until the tenth day, when their action brought the temperature to normal. January 15, six weeks after the operation, a small abscess formed in the upper angle of the scar and discharged half an ounce or less of pus, and left a sinus which persisted for seven weeks longer. The patient was kept in bed for a month to guard against secondary hæmorrhage.

Four days after the ligation a very slight pulsation was observed in the aneurism and in the right radial artery. This was more marked when the patient was allowed up. Pulsation in the carotid returned about the same time, but was centripetal, and evidently due to collateral circulation, especially through the superior thyroid artery. At one time (from December 18 to about January 20) there was a distinct systolic pulsation visible in the right external jugular vein, which afterwards disappeared. There were no signs of disturbance of the innervation of the larynx either before or after the operation, but the patient complained for a long time of great soreness in the pharynx, although no cause could be found for the sensation. When the patient was shown to the Surgical Society in January there was almost no pulsation in the aneurism, but as this seemed to be increasing later, it was determined to apply additional ligatures.

Accordingly, on March 13, 1900, under ether anæsthesia, an incision was made along the inner border of the sternomastoid muscle, and the carotid exposed. No pulsation was observed in the lower part of the vessel, which appeared full of solid blood-clot, but for safety a ligature was placed around it and tied with-

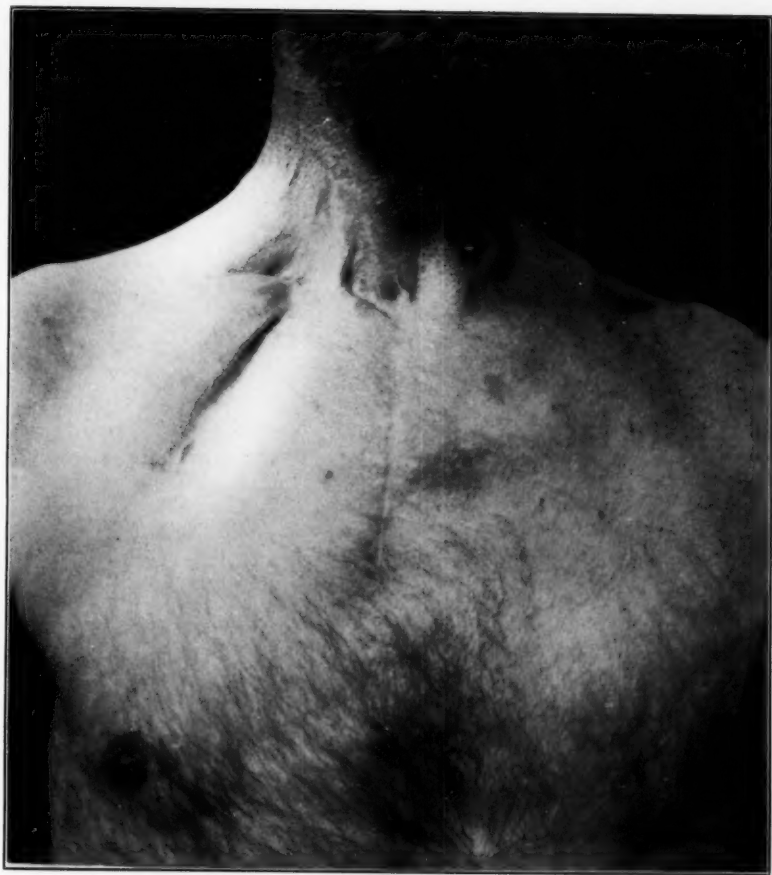
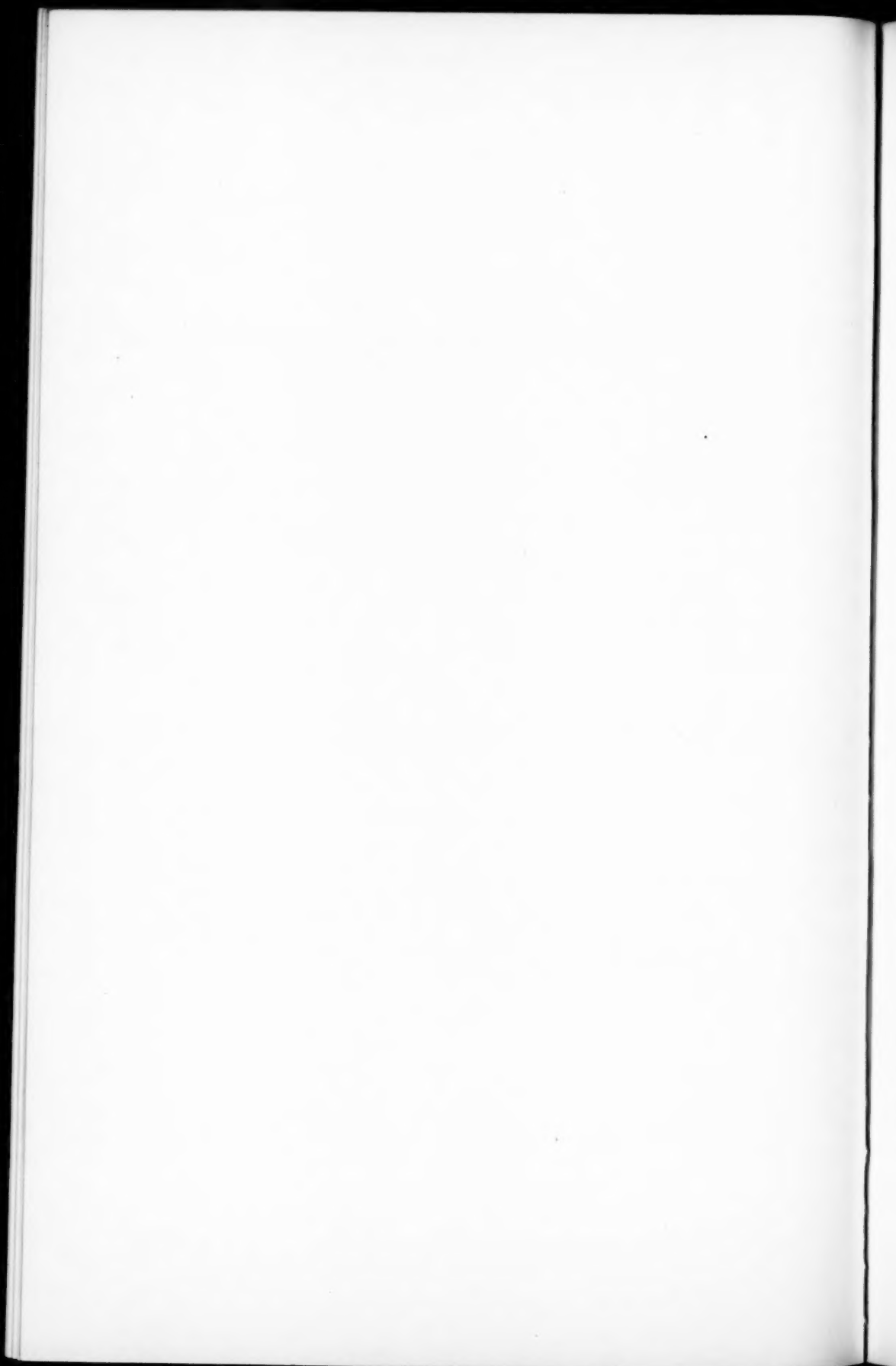


FIG. 1.—Showing scars of Milton's operation and of temporary division of the clavicle.



out dividing the coats of the vessel. Another incision was made along the clavicle from the lower end of the first, and a third obliquely downward and outward from the same point. The clavicle was thus exposed and divided between the inner and middle thirds with a Gigli wire saw. The first part of the subclavian was thus brought into view, and found to have a faint but decided pulsation. The innominate was evidently imperious. The subclavian and the carotid had both regained a normal calibre, being much smaller than at the previous operation. There was no clot in the subclavian. The aneurismal dilatation began in the second portion. Pressure at different points proved that the pulsation in the sac was not retrograde, and that it must come from some branch of the first part of the subclavian. A ligature was applied to the first part of the subclavian just beyond (distal to) the thyroid axis. This arrested pulsation in the sac, but it continued in the first part of the subclavian. Beyond the ligature (distally) was a small vertical branch, which was assumed to be an irregular vertebral, although it was small and did not pulsate. Another ligature was thrown around the subclavian just beyond (distal to) this branch. No vertebral artery could be found arising centrally to the thyroid axis, and it was believed that the remaining pulsation in that part of the vessel came from the internal mammary artery.

The divided clavicle was then wired and the wound closed. The temperature rose again to 102° F., and there was considerable pain, and superficial infection developed in the upper angle. The infection in this case and in the first operation was, I think, to be ascribed to the very thick and rough wrinkled skin of the patient, which rendered its thorough sterilization almost impossible. A sinus formed and burrowed to the bone, and the wire had to be removed, so that fibrous union with some displacement was the best which could be obtained. The bone had attained firm fibrous union by the end of May, and the last sinus was closed by June. On October 24, 1900, the patient was shown again in good health, with no trace of the aneurism, and a strong, although not bony, union of the clavicle.

The amount of disfigurement caused by these two methods is very different, as can be easily seen by comparing the two scars in the photograph (Fig. 1) of this patient taken

when he was discharged. In two or three other cases in which the clavicle has been divided, I have had the same experience of delayed union, malposition of the ends, and liability to infection and necrosis. The great advantage of splitting of the sternum in these respects is evident.

Milton's original idea of splitting the sternum throughout its entire length presents an admirable method of exposing the parts in the anterior mediastinum. Its possibilities are well shown by a case recently reported by him (*Lancet*, January 26, 1901), in which he removed a broken tracheotomy tube from the right bronchus by this means of approach. But the limitation of the bone cutting to the manubrium, as in the case I have just related, is sufficient for the majority of operations, as it gives access to all the great vessels at the root of the neck and also to the lower part of the trachea. The risk of the more extensive operation is mainly that of injury to the pleura, which is avoided in the modification. At this level the pleuræ are separated by a wide interval. The attachment of the sternothyroid muscles to the posterior surface of the manubrium also affords protection to the pleura and to the deeper parts, and enables the surgeon to detach the periosteum freely without danger of injury to those structures. When the bone has been retracted the periosteum can also be much more easily incised without danger to the parts below on account of this additional layer. The two halves of the manubrium after the transverse division of the bone at the first or second intercostal space can be retracted so as to leave a free interval of from one to two inches, quite as much as can be obtained by dividing the entire sternum.

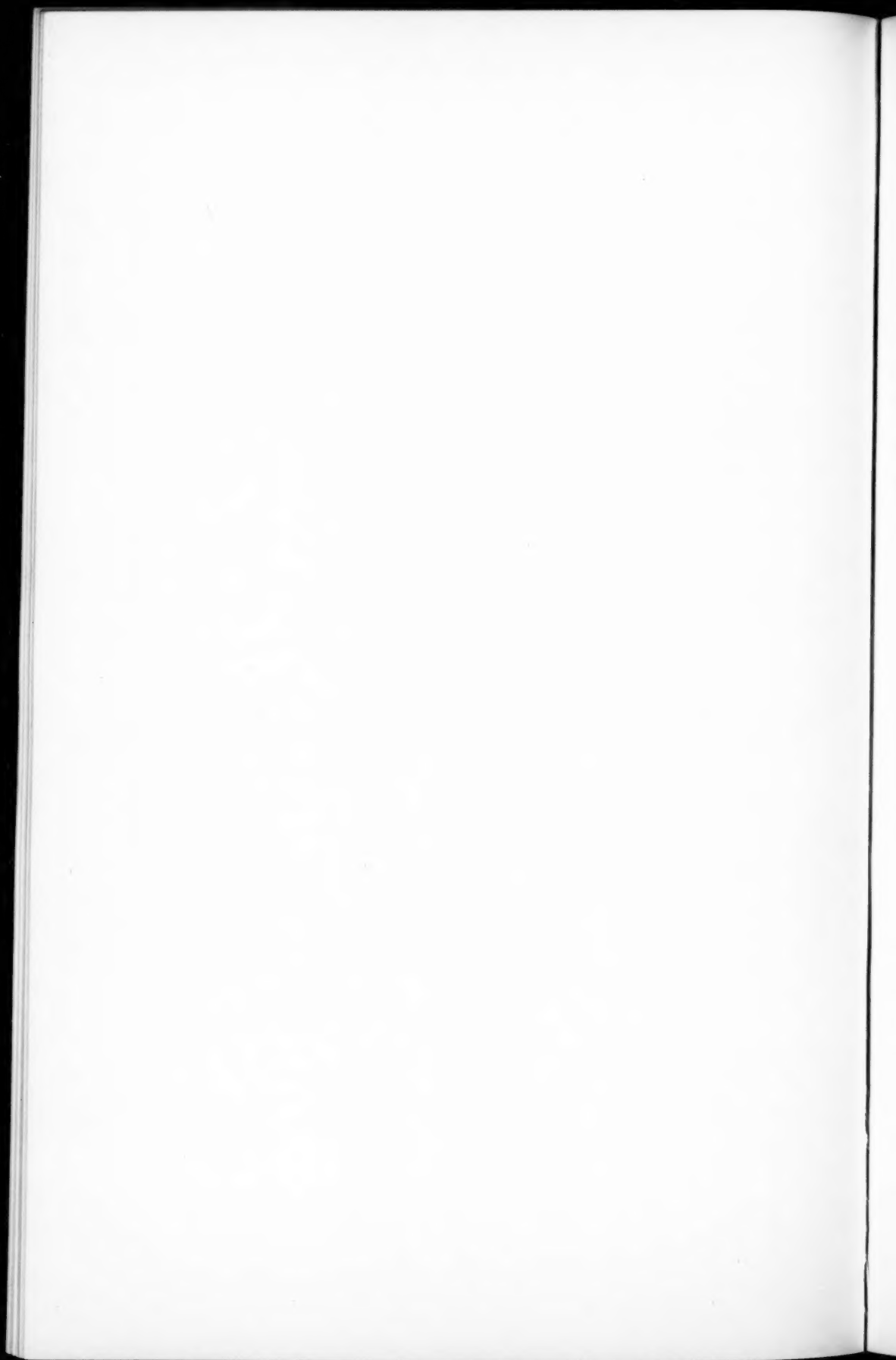
The steps of this modified operation are as follows:

(1) A median incision is made from the larynx to the middle of the sternum or lower, dividing the skin and deep fascia above and the periosteum also below.

(2) The sternohyoid and sternothyroid muscles are followed down to their sternal insertion, retractors being placed so as to draw the soft parts at the base of the neck widely apart.



FIG. 2.—First stage, bone divided and retracted, showing sternohyoid muscles and posterior periosteum of the manubrium. The trachea shows through a small incision between the muscles.



(3) A transverse incision is made through the periosteum along the upper border of the manubrium, and the periosteum and muscles detached from the posterior surface of the bone by blunt elevators and the finger as far as can be reached.

(4) The ordinary amputation saw is then applied to the bone in the line of the vertical incision in the periosteum, the soft parts in the neck and behind the sternum being protected by flat metal strips. The saw is held with its point turned towards the neck and its handle towards the ensiform cartilage. It should cut most deeply above, and entirely divide the manubrium at its upper border, the cut being more shallow below, and only grooving the bone at its lower end. This obliquity of the cut necessitates the long skin incision which has been described.

(5) A stout chisel is then applied in the saw-cut at the superior border of the manubrium, and the thin layer of undivided bone on the posterior surface is made to give way as the wedge action of the chisel forces the two halves apart.

(6) The skin being well retracted, a transverse incision is made in the periosteum across the face of the bone at the level of the first or second intercostal space, and the chisel is applied in this line directed obliquely outward from the middle line on each side so as to divide each half of the bone from the body of the sternum. The instrument must not be allowed to cut entirely through the bone at the outer border for fear of injury to the pleura or internal mammary artery. Both lie a little distance from the bone, so that the danger of wounding them is not great.

(7) Strong retractors are then inserted in the median saw-cut, and with a little force the two halves can be sufficiently separated to allow access to the periosteum, which should be carefully incised or scratched through with the point of the knife, beginning above where the danger of damage to the subjacent parts is least. As the periosteum is divided, the halves of the bone can be more widely separated, and this interval gradually extends from an inch to nearly twice that dis-

tance as the steady strong traction is maintained during the subsequent operation. A separation of three centimetres can be obtained in any case, and this is abundant. The small intercostal branches of the internal mammary artery are somewhat tortuous and sufficiently long to allow free motion of the bone without receiving injury. The appearance of the floor of the wound is shown in the sketch from the cadaver, Fig. 2.

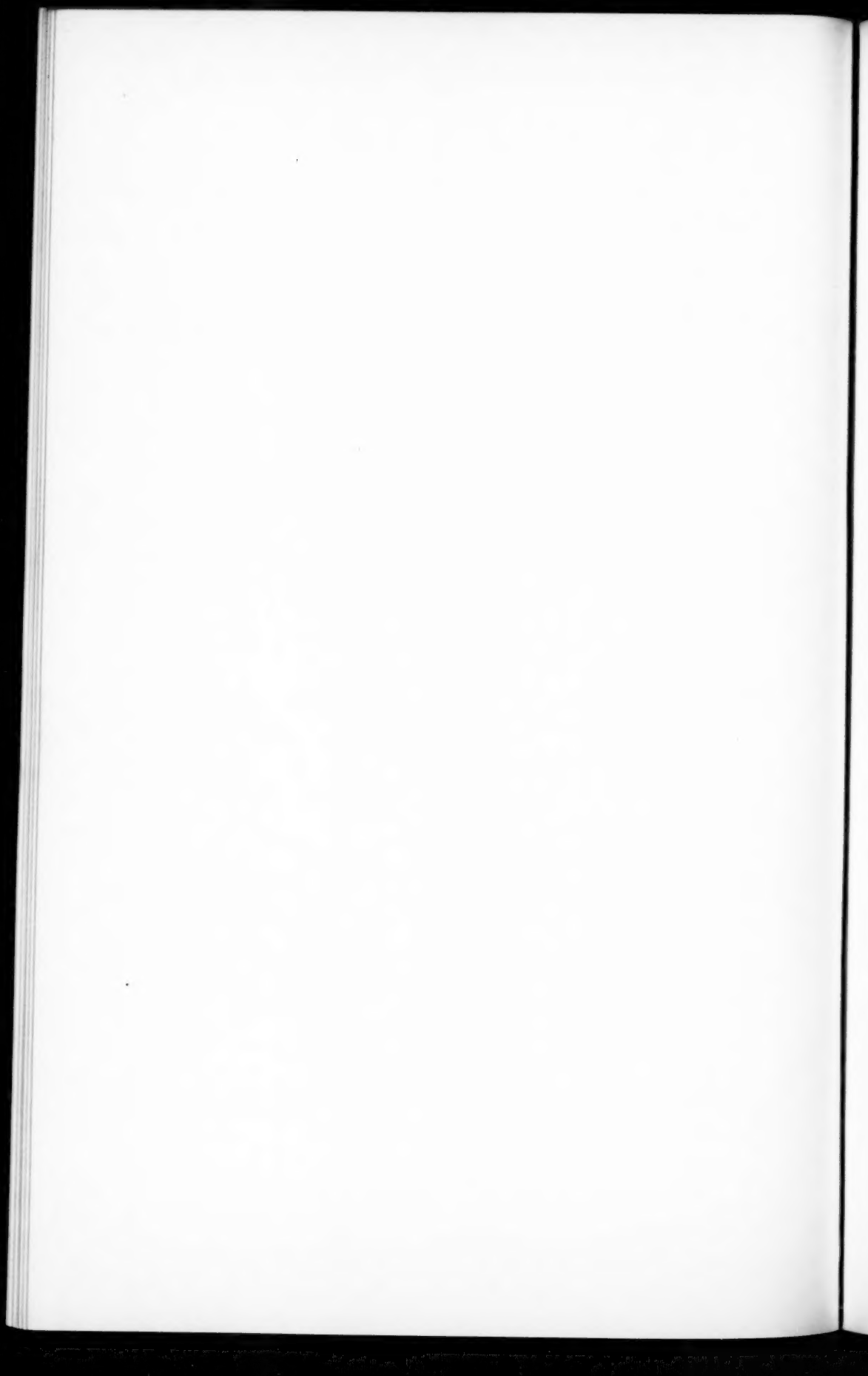
(8) The muscles and fascia are then divided by blunt dissection, or with forceps and scissors, in the median line, beginning above, double ligatures being applied to the veins which cross the line of incision. The trachea and great vessels at the root of the neck can be freely exposed, as in Fig. 3. The subject from which this sketch was made shows a rather unusually low origin of the recurrent laryngeal nerve. In the case of operation for ligature of the innominate described, the nerves were not seen at all; and even in a ligature of the first part of the subclavian by this method I do not believe there would be any danger to that nerve, because the sheath of the vessel would be opened as soon as it was exposed, and the subsequent manipulations would take place within the sheath completely separated from the nerve. In applying a ligature to the innominate artery, it should not be forgotten that a small arteriole sometimes takes origin from that vessel on its posterior surface, which might give trouble to the operator.

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FIG. 3.—Full exposure of trachea, innominate artery, arch of aorta, and left innominate vein—crossing the latter. The right pneumogastric and recurrent laryngeal nerves are seen—the latter originating unusually low in this subject.



ABSCESS OF THE LIVER.¹

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THE general subject of abscess of the liver is one of such vast proportions, particularly in regard to its clinical features, that an exhaustive consideration of the subject in its entirety would exceed the limits of this paper.

In their origin, a very sharp line of demarcation may usually be drawn between that class of cases in which the pyogenic factor reaches the liver from some other part of the body, in other words, the exogenous, and the endogenous in which there is reason to believe that the development of the abscess takes place in the liver tissue independent of any recognized cause, extraneous or otherwise, the so-called primary or idiopathic abscess of the liver.

The development of the secondary abscess is due to the transmission of infectious material in one of several ways; most frequently such material, consisting of a portion of a thrombus, the result of some inflammatory process in one or other of the organs drained by the portal system, usually from the base of a dysenteric ulcer, reaches the liver through the portal vein.

Next in frequency, a similar pyogenic embolus, springing from some distant point of infection, may run the gauntlet of the pulmonary capillaries and then reach the liver tissue through the hepatic artery, the so-called pyæmic.

Least frequently the infectious material passes into the liver substance along the bile-ducts, representing the spreading

¹ Read before the New York Surgical Society. February 13, 1901.

by continuity of a pre-existing infection which has developed in a case of complicated or long-standing cholelithiasis. Then, again, we have those cases of abscess which develop in the liver as a result of infectious material gaining access to that organ through the lymphatic system, which represent the extension of an abscess of which the liver originally formed a part of the wall. There are still others which develop as a result of the entrance of germs along the surface of the peritoneum, until the peritoneal wall of the liver is reached, and the organ also then becomes involved. To these must be added those abscesses which result from the infection of echinococcus cysts.

In all of these cases, however, the existence of the primary trouble is generally manifested by marked pathological changes and symptoms which indicate the site and nature of the lesion, and the liver abscess must be considered in the light of a complication.

In the so-called primary cases, however, the abscess develops without the existence of any other recognized organic change. In some of these so-called primary cases, however, the abscess is really of secondary origin; although, at the time the abscess develops, the primary lesion has disappeared. Cases have been reported in which abscess of the liver developed months after the symptoms of a dysenteric attack had subsided; and in one (Case II) of the cases reported in this paper the abscess developed a number of months after the patient had returned from a tropical country, in which abscess of the liver was of frequent recurrence, and where, presumably, the patient had suffered from some intestinal disturbance so slight as not to attract his attention.

It is also highly probable that a condition of ulceration, dysenteric or otherwise, may exist in the wall of the alimentary canal without in any way attracting the attention of the patient. That a patient, for example, with ulcer of the stomach, may remain ignorant of its presence until perforation suddenly develops, is a well-recognized fact. Similarly, in the lower bowel, a carcinomatous ulcer may first attract the pa-

tient's attention, at a time when examination reveals an area of ulceration so extensive that it must have existed months previous to the manifestation of the initial symptom.

It is highly probable, therefore, that slight, or even moderate, ulceration in some portion of the bowel may exist without giving any evidence of its presence, and yet at any time be the cause of an infectious embolus, with consequent development of an abscess in the liver.

If the occurrence of the "primary" or "idiopathic" abscess is to be accounted for in this way, the bacteriological examination of the resultant pus should yield one or other of the pyogenic germs, for such emboli must invariably carry with them some one or other of these organisms. In the cases reported, Case I contained staphylococci. How, on the other hand, are we to account for these "primary" or "idiopathic" cases in which the bacteriological examination fails to disclose the presence of any pyogenic organism?

In this class of cases the origin of the abscess cannot satisfactorily be accounted for. It may be due to an impaired vitality of liver tissue, which results from the action of the malarial organisms; the liver tissue most seriously involved breaking down into abscess matter. The vitality of the liver tissue may also be impaired through local trauma, after the occurrence of which the accidental presence of a pyogenic organism may readily convert the damaged tissue, possessing diminished powers of resistance, into pus, and subsequently the resulting abscess becomes sterile through the antiseptic virtue of the bile. This, however, is mere speculation. The fact remains that malaria is frequently associated with liver abscess, and that not infrequently abscesses due to this and other causes are encountered of which the pus is sterile.

The pathological condition of abscess of the liver varies according to the nature of the cause. In those of dysenteric origin, the abscess is usually single, although it may be multiple. In those due to pyæmic embolus, the abscess is usually multiple. Its location is generally in the right lobe, exceptionally in the left, possibly in both. In twenty-one cases collected

by Loisan, in sixteen the right lobe, in one the left, and in four both lobes, were involved. Analysis of these cases showed ten single abscesses, two double, three triple, and six multiple, the number varying from five to twenty or more.

In the cases reported here, all were situated in the right lobe. One was multiple. In cases of multiple abscess, we must distinguish between those in which the pathological condition of each abscess is identical, and those in which the different abscess cavities show different stages of tissue degeneration. In the former, the several abscesses develop as a result of the simultaneous or nearly simultaneous lodgement of a corresponding number of emboli. In the latter, a considerable interval may intervene between successive abscesses, and this may be sufficiently long for convalescence to have become established, only to be interrupted by a recurrence of the trouble. Richelot mentions a case in which the patient was subjected to three different operations for as many abscesses in parts of the liver widely separated, each operation being followed by subsidence of the symptoms and prompt union.

In Case III the autopsy showed an identical condition of the walls of the different abscesses, which must therefore have formed simultaneously. In those cases where this formation is consecutive in character, those abscesses of later formation may be due to a reinfection from the primary abscess in some distant part of the liver, or to the subsequent lodgement of additional infectious emboli. A possible cause, not to be overlooked, consists in the exploration of different parts of the liver with the same needle. In the early efforts to find the abscess, the needle may have reached the peripheral zone of the abscess cavity, and in the failure to find pus have been withdrawn. Its point would thus be contaminated with the agents of infection, which would naturally be introduced into distant parts of the liver in the further efforts of exploration. To avoid this accident, a freshly sterilized needle should be attached to the syringe for each exploration.

When the abscess reaches the surface of the liver, a considerable variety of interesting pathological conditions develop,

according to the direction in which the abscess points. The limits of this paper preclude the further consideration of this part of the subject at the present time.

The symptoms of abscess of the liver depend upon whether its origin is primary or secondary. If the latter, the symptoms comprise those of the original disease, to which are subsequently added those of the liver abscess, and the diagnosis is usually not difficult.

In the primary or idiopathic cases the symptoms may best be considered in two stages: first, the symptoms before appreciable enlargement of the organ, while the abscess is still enveloped in liver tissue, and, secondly, those symptoms which are associated with the increase in the size of the organ, when the abscess is gradually approaching its surface.

In the first stage, while the difficulty of diagnosis must be emphasized, the importance of an early diagnosis, from a prognostic stand-point, cannot be overlooked. The difficulty in diagnosis is accounted for by the fact that there is such a wide variability in the character of the symptoms in the early stages. This is particularly the case in the subjective symptoms, both general and local. The objective symptoms, owing to the depth of the process in an organ not the seat of enlargement, are obviously scant, but do not vary as markedly as the subjective symptoms.

The subjective symptoms in the first stage are local and constitutional; of the former, one of the most constant is pain, the character of which varies from sharp lancinating (Case I), in those cases where the process is acute, to dull aching (Cases II and III), where the abscess is one of slower formation. The situation of the pain is usually over the liver proper, and may be referred by the patient to either a point, in front, below the costal margin in the mammary line, or less frequently, to a point behind, over the lower ribs (Case III). It is only after the abscess approaches the diaphragmatic surface of the liver that the patient complains of the classical scapula neuralgia, usually on the right side, occasionally on both sides.

The pain is intensified by any movement which disturbs the position of the liver or which presses it against the bony thoracic wall. It is also intensified by deep inspiration. As the abscess approaches the surface of the liver the intensity and character of the pain may change, owing to the development of a plastic peritonitis or pleurisy due to Nature's effort to protect herself against the sudden discharge of the contents of the abscess into one of the large visceral cavities. It is important to emphasize the fact that such a local fibrinous inflammation may develop when the abscess cavity is several inches distant from the surface of the liver. In Case I, on her admission into the hospital, the pain was not sufficiently severe to overcome the disinclination of the patient to an operation. At least ten days passed by before the patient gave her consent, being largely influenced by the fact that for several days the pain had become very sharp and knife-like in character. At the time of the operation, the visceral and parietal layers of peritoneum were found adherent over an area about the size of a silver dollar, although pus was detected only after the needle had traversed two and one-half inches of liver tissue.

Frequently, at the beginning, the pain is not sufficiently severe to incapacitate the patient. In Case I, the patient continued to perform her household duties for several days after the first appearance of this symptom. Occasionally the onset is more rapid, and the patient is confined to bed early in the development of the trouble.

The constitutional subjective symptoms are due to the absorption of the purulent products, and are identical with those which are associated with an abscess in any part of the body—malaise, prostration, loss of appetite, sensations of heat and cold, sometimes actual chills, occasionally repeated, may all be present. There is frequently nausea and occasionally vomiting. The patient is restless, sleepless, and at times may be slightly delirious.

The fever in this early stage is generally high, although its type is very apt to be irregular. In the cases herewith reported all were kept under observation for from one to two

weeks before operation, and during that time the temperature was of hectic type and varied between 99° and 105° F.

The pulse corresponds to the temperature, and varies between 100 and 120, being less rapid in cases of slow invasion. In many of these cases icterus develops during the early stages. This is usually of the obstructive variety, due to the pressure of the abscess cavity on the adjacent liver tissue. It is correspondingly slight in degree, and is very apt to vary from day to day, sometimes almost disappearing. In Case I the onset of the jaundice was observed about twelve days after the initial pain, in Case II two months, and in Case III this symptom was absent.

On examination, the process being deeply seated, there is no change in the configuration of the abdomen. The patient naturally seeks the position of greatest ease, lying on the back with a slight inclination of the body to the right side, and with the right leg flexed. There is marked inhibition of abdominal respiration, with a corresponding exaggeration of the thoracic type. French observers have emphasized the importance of observing the movement of the diaphragm with the X-ray. By this means the movement of the right side of the diaphragm is seen to be markedly impeded, while the left portion, although restricted, has a more extensive range of action. None of the patients herewith reported were subjected to this procedure, although, in doubtful cases, I should think it a valuable expedient.

There is usually increased rigidity of the right rectus muscle, as well as of the muscle structures which overlie the anterior surface of the right lobe; and this is particularly marked over the upper portions of these muscles, while the abdominal wall below the free edge of the liver is less rigid, and in the lower zone of the abdomen the wall is perfectly flaccid.

Pressure increases the rigidity, and in Cases I, II, and III elicited tenderness. Neither by palpation nor percussion can any change in the size of the liver be detected.

The onset of a beginning pleurisy or peritonitis may give

the characteristic fremitus as well as the friction sound which is peculiar to these conditions. In Case I, however, notwithstanding the presence of the plastic peritonitis, no friction sound could be obtained.

In this early stage, the diagnosis of the existence of an abscess may be rendered a probability by the counting of the leucocytes of the blood. The literature on the subject of abscess of the liver contains as yet no reference to such a clinical examination. Its value, particularly in those cases in which an exploration, owing to the sparse development of local symptoms, seems a doubtful expedient, cannot be too strongly emphasized. In all these cases herewith reported a marked leucocytosis existed, as follows: In Case I, 10,000 to 12,000; in Case II, 20,000; in Case III, 16,000 to 19,000 (three examinations).

It cannot be denied that abscess of the liver can run its entire course with symptoms so obscure as to escape detection at the hands of even a careful observer. How much more likely is this, then, to obtain in the early development of an abscess before it becomes sufficiently large to change the dimensions of the liver, or to make its pressure known by the process of pointing? But it is in this same early stage that accurate diagnosis is so important, in order to render operative interference of value to the patient, and under these circumstances persistent leucocytosis, in the presence of any local symptom, no matter how slight, should indicate an explorative procedure.

In the second stage, when the abscess has changed the configuration of the liver, even although it may not as yet have reached its surface, physical examination readily yields the signs of an asymmetrical enlargement of the organ, while, if the pus has extended into tissues beyond, its presence may be detected by the usual physical signs of an abscess, varying only according to its position. Either before the abscess has reached the surface of the liver, or in its later stages, the presence of the pus may be detected by the exploratory needle. This procedure, formerly much in vogue, is now utilized to search for the abscess cavity only after the surface of the liver

has been exposed by operation: Although it may be tried as a simple exploratory measure, in many cases prior to operation without accident, yet it undoubtedly subjects the patient to the risk of sepsis from the escape of a small amount of pus introduced into the tissues, particularly the peritoneal cavity, during the withdrawal of the needle, as well as to the risk of puncture of intervening viscera, which may have been fixed in an abnormal position by plastic exudate (to the surface of the liver); also, rarely, fatal hæmorrhage into the peritoneal cavity, after exploratory puncture, has been observed.

The treatment of abscess of the liver is palliative and radical. As in a great many other operations in pre-antiseptic days, the fear of septic peritonitis following incision and drainage of the abscess deterred many surgeons from carrying out this plan of treatment. For it was substituted aspiration of the abscess cavity, or the evacuation of its contents with the trocar and canula. It is needless to state the objections to these methods, and without further reference we may proceed to the consideration of the operative procedures for the relief of this condition.

These may be grouped as follows: (1) Transpleural, anterior, posterior; (2) Subpleural, anterior; (3) Transperitoneal, anterior, posterior.

The selection of the most suitable procedure in any individual case depends entirely upon the situation of the abscess. That operation is chosen which will open the abscess cavity at a point nearest the surface of the liver, and which, also, will afford the best drainage after the contents of the abscess are evacuated.

In those cases in which the location of the abscess can be determined by the character of the subjective symptoms and the physical signs, the selection of the proper surgical procedure is devoid of difficulty. In many cases, however, the uncertainty of the exact situation of the abscess cavity precludes a proper choice of operation, and under these circumstances the abdomen is opened by the anterior transperitoneal method, inasmuch as in the majority of cases the abscess is

situated in the right lobe, and is nearer its anterior than its posterior surface. The situation of the abscess is then accurately determined by means of the exploring needle; and if the above-mentioned conditions governing the incision and drainage of the abscess cavity can be satisfactorily carried out, the operation is continued and concluded by this method; otherwise the abdominal incision is closed and the abscess opened and drained by a more suitable route.

Of these different procedures, the posterior subpleural consists in making an oblique incision over the ninth rib behind, followed by the subperiosteal resection of the rib without, if possible, opening the pleural cavity. After this has been accomplished, and after the suture, if necessary, of any accidental rent in the pleura, the dependent portion of the pleural cavity is separated by blunt dissection from the chest wall and diaphragm, this latter structure penetrated, and the abscess cavity opened and drained.

In the anterior operation, a similar procedure is carried out after resection of the seventh or eighth right costal cartilage.

In both cases the raising of the pleura can be accomplished only when that membrane has not been reached by the inflammatory process; otherwise, the presence of adhesions renders it impossible. In the anterior operation, however, owing to the presence of the gastroduaphragmatic sinus, there is a considerable interval between the base of the pleura and the diaphragm, and the upper surface of the muscle may be reached without damage or disturbance to the serous membrane. Posteriorly this space is absent, and in the presence of adhesions the operation could not be carried out without opening the pleural cavity.

The transpleural operation is therefore carried out chiefly through the posterior incision. In it, the pleural cavity is necessarily opened, and the danger of a subsequent empyema from the contamination of the discharging pus is incurred. This can be obviated, however, by suturing the opposed pleural

surfaces together before the abscess cavity is opened, or, if this is impracticable, by temporarily packing the lower pleural cavity with gauze, and opening the abscess only when, after several days, adhesions have formed which shut off, and therefore guard, the upper portion of the cavity.

The anterior transperitoneal operation was practised in each of the cases reported in this paper, as follows:

An incision three inches in length, extending upward from the lower border of the liver parallel to the outer border of the right rectus muscle, was carried through the structures of the abdominal wall into the peritoneal cavity. The anterior surface of the right lobe of the liver presented in the wound, and at the lower angle the condition of the gall-bladder could be ascertained.

The location of the abscess cavity was then detected by an exploring needle of large size, and its dimensions were roughly determined by the excursion permitted of the end of the needle.

If the operation is to be concluded immediately, the peritoneal cavity is shut off by sutures joining the parietal peritoneum to the corresponding visceral portion, and the abscess cavity opened with the cautery. The advantages of this, the so-called primary operation, consist in the evacuation of the pus at the earliest possible moment, as well as the prevention of the possible rupture of the abscess cavity into the peritoneal cavity, if the opening with the cautery is delayed.

Its disadvantages consist in the fact that the suture of the parietal and visceral peritoneum is very difficult, and can be obtained only by passing the sutures through the liver substance, and further, after the suturing has been satisfactorily accomplished, the pus may still gain entrance into the peritoneal cavity, inasmuch as the suture line, not over-strong, may yield to the coughing of the patient, or to attacks of vomiting, so frequent during the recovery of the patient from the anæsthetic.

In the cases reported, the following method was adopted.

After the detection of the pus, the needle was allowed to remain in the abscess cavity, a loop of silk around its "neck" being attached laterally by plaster to the abdominal wall. The barrel of the syringe being removed, the surface of the liver around the point of entrance of the needle was packed with iodoform gauze, after the angle of the incision had been joined by suture. An ordinary dressing was then applied and the patient placed in bed. Subsequent procedure depended upon the post-operative condition of the patient. If no change occurred, the parts remained undisturbed for from five to six days. At the end of that time the dressing and packing were removed and the abscess cavity opened by the cautery. If, on the other hand, the patient's condition changed for the worse (and this did not occur in the cases reported), the abscess could be partially or completely emptied of its contents by aspiration, without any material risk of peritonitis.

This method of treatment not only allows of the evacuation of the contents of the abscess, should this be considered desirable, but it effectively prevents the rupture of the abscess in any other direction. The needle also serves as a most useful guide for the insertion of the cautery, and during the interval of four to five days, the opening through which it passes into the abscess cavity is slightly enlarged by the discharge of pus along its side.

With the opening of the abscess, the interior of the cavity is carefully searched for secondary foci, and is then drained by the insertion of several large rubber drains previously invested in ordinary gauze.

The posterior transperitoneal is especially adapted for abscesses deeply seated in the right lobe. A careful search of the literature has revealed no case in which this procedure has been practised. This part of the liver, however, is easily accessible through the lumbar incision exposing the right kidney, and its dark, glistening surface normally shines through the posterior parietal peritoneum, which can easily be incised to the outer side of the kidney, and above the hepatic flexure of

the colon. In all cases opened anteriorly, in which proper drainage cannot be secured by ordinary means, this portion of the right lobe might be attacked with the purpose of improving the drainage through a counter-opening in the most dependent part of the abscess cavity.

The after-treatment of these abscesses consists in providing conditions of suitable drainage. In Case I, the persistence of the temperature and pulse elevation for two weeks was followed by elevation of the left side of the bed, the patient being prevented from falling out by being suspended in a form of hammock apparatus, with its point of attachment to the elevated side. This procedure was followed by a steady diminution of the temperature of the patient, and the abscess cavity gradually and steadily contracted in size.

In most of the other cases, this position proving uncomfortable, satisfactory drainage was accomplished by the application of the Sprengel air-pump principle, recently advocated by Dr. Dawbarn in suprapubic drainage of the bladder. In carrying out this principle, a single large drainage tube was employed, and around it, at its point of entrance into the liver, sterile gauze was firmly packed. To its extremity a rubber tube was attached, which joined the vertical tube, connecting a large pail filled with saline solution above the head of the bed, and a receptacle at a slightly oblique angle on the floor. The amount of "suction" was easily regulated by varying the diameter of the vertical tube, and by suitable stop-cocks the action of the apparatus was made intermittent, as a continuous action would predispose to hæmorrhage from the wall of the abscess cavity, as well as loss of bile from the liver substance.

The action of the apparatus was very satisfactory, and particularly was its action efficacious in a large echinococcus cyst of the liver of several years' standing, in which, under this plan of treatment, the patient recovered without any marked depreciation of general condition.

In Case III, autopsy disclosed a condition of multiple foci, but before the patient's death the large abscess cavity had

been satisfactorily drained, and did not show the results of pus retention.

In these cases, fortunately uncommon, a cure can be effected only when all the abscesses are opened and drained by the surgeon, and as this is very difficult to accomplish, recovery from multiple abscess must be very unusual.

CASE I.—March 24, 1900. K. H., aged thirty-two years. Previous family and personal history negative, with the exception of the presence of a uterine fibroma for the past ten years, which was noticed accidentally, and which has caused no symptoms.

Ten days before admission, patient first noticed a soreness in the right hypochondrium; there was slight swelling. There was some nausea, but no vomiting; both the soreness and swelling increased gradually, and the region became tender on pressure, while deep inspiration intensified the pain. For the past week, patient has been confined to bed on account of the pain and some fever. During this time there have been several slight attacks of vomiting. No chill has been present; no jaundice. There has been marked prostration; the urine is high colored and scalds the parts when passed. Its specific gravity is normal; there is a trace of albumen and a few casts on microscopic examination.

Examination.—There is a distinct fulness in the right hypochondrium and adjacent epigastric region, situated below the costal margin and above the free edge of the liver, which can be felt about two inches below the costal arch; this fulness extends nearly to the mammary line on the right and beyond the median line on the left, and is markedly sensitive on pressure. Over it the abdomen, which elsewhere is soft and flaccid, is firm and rigid. Temperature, from 101.5° to 104° F.; pulse, on admission, 120; respirations, 28.

March 26.—Slight jaundice for the first time. Pain still intense. Temperature variable; considerably lower in the morning than evening.

April 5.—The local condition is unchanged. The pain is more intense. Jaundice still present, of moderate intensity.

Operation.—Gas and ether. Incision along outer border of

right rectus muscle, extending upward from the lower border of the liver. Parietal peritoneum was found adherent to the visceral layer, over an area the size of a half-dollar. Liver symmetrically enlarged. It was more convex at site of adhesions than normal. Gall-bladder and ducts normal, abscess cavity detected in right lobe at a depth of two and one-third inches just to right of linea alba, and through the needle several ounces of dark chocolate-colored pus were removed. Staphylococci in pus; abscess shows red and white cells and degenerated liver cells. The needle was left *in situ*, surrounded by layers of iodoform gauze, and the lower part of the incision brought together with interrupted sutures. Sterile dressing. On recovery from anæsthetic, patient felt less pain, and generally more comfortable than before the operation.

April 10.—Chloroform. Abscess cavity opened thoroughly with the cautery, and a large tube, enveloped with iodoform gauze, inserted. The accompanying loss of blood was slight.

April 17.—The discharge from the abscess cavity has been abundant and has contained considerable bile. Temperature has varied between 99° and 102° F.; pulse is stronger and less frequent (from 90 to 110).

May 1.—The abscess cavity is considerably contracted, but the drainage is not satisfactory, and patient continues to have an evening rise of temperature. The patient was placed on her right side, and drainage thereafter very much improved; the abscess cavity contracting rapidly. Pulse still from 90 to 100.

May 12.—Temperature normal. Patient's general condition has steadily improved.

May 30.—Out of bed. Pulse normal.

June 13.—Sinus, two and one-half inches deep. Patient leaves the hospital.

October 1.—Patient working for past two months. Wound entirely healed. Health excellent.

CASE II.—June 12, 1900. P. G., aged thirty-eight years; male. Two years ago had several attacks of diarrhœa, while on a visit in the South, with bloody stools and tenesmus. For the past two and one-half months there has been pain in the right lumbar region, not constant and not severe, of a dull, aching character. There has also been some cough without expectora-

tion. During the greater part of this period patient has been in bed and unable to work, on account of prostration and fever. There have been no chills or jaundice at any time.

For two weeks previous to operation, patient had well-marked hectic temperature, varying from 99.5° in the morning to 104.5° F. in the evening. Patient walked into the hospital May 25, and for the past two weeks has been treated on the medical side.

Examination.—Posteriorly, there is flatness over right base from angle of scapula downward; on the left side, from two inches below angle downward. On the right, fremitus and breathing sounds are much diminished, more than on the left. There are no râles; there is no change in mensuration.

Liver, anteriorly, extends two inches below and parallel to costal margin. There is marked tumefaction just to the inner side of the gall-bladder and above the free margin of the liver. This area is tender on pressure, and tenderness may also be elicited over the tip of the eleventh rib. There has been, and still is, marked rigidity over the right upper part of the abdomen.

Blood count on three different occasions showed a leucocytosis varying between 16,000 and 19,000. Urine normal both before and after operation.

Operation.—June 15, gas and ether. Incision two and one-half inches in length, from eighth costal cartilage downward through the rectus. Peritoneal cavity free of adhesions. Liver symmetrically enlarged; color is normal; the right lobe appears slightly bulging in front. Exploring-needle detected pus at a depth of one and one-half inches in an upward and backward direction in the right lobe, two inches to the right of the median line. Needle tied *in situ* and protected with gauze.

19th.—Patient's temperature has varied from 98° to 102.5° F. in past four days, having reached 104° on the evenings of the four days preceding operation.

Secondary operation with cautery followed by continued improvement for ten days.

29th.—Both temperature and pulse higher to-day: pulse, 112; temperature, 104.5° F. and of septic type. Patient irrational, and, notwithstanding infusions, gradually became weaker and died July 4.

During the period after the primary operation there was considerable increase in the size of the passageway occupied by the needle, and at the time of the secondary operation over one quart of pus was evacuated.

The autopsy showed a condition of multiple abscesses of the liver, of which the largest had been incised and drained.

CASE III.—June 20, 1900. S. J. Thirteen months ago patient lived in the West Indies for a considerable length of time. There was, however, no history of diarrhœa or other alimentary disturbance during that time.

Three months ago a dull aching pain developed in the right hypochondriac region, and one week later an attack of malaise and prostration. Patient was obliged to stop working. During this time and subsequently patient felt feverish afternoons. Two months ago, for a period of two weeks, patient vomited a little "phlegm" each morning.

For the past month the patient has had daily chills, followed by fever and sweating. He also suffered from constant pain of considerable severity. There was some loss of weight and strength. Since June 16 patient has had from three to ten movements each day.

Physical Examination.—Practically the same as in Case II, both with reference to the pulmonary as well as the abdominal signs. The swelling in the right hypochondriac region well marked. The edge of the liver below the swelling, and is four inches below costal arch. Temperature of hectic type, reaching 102.5° F. in afternoon; pulse, from 110 to 120. Small amount of albumen (5 per cent. by volume) in urine; leucocytosis, 20,000.

Operation.—June 22, gas and ether. Incision two and one-half inches long, from junction of eighth and ninth costal cartilages, vertically downward through the rectus. Parietal peritoneum found adherent to serous coat of liver. The abscess cavity was near the properitoneal space, the fatty tissue of which was markedly œdematous and infiltrated. The abscess cavity was opened and one and one-half quarts of thick grumous pus evacuated. There was slight odor. The abscess cavity, eight inches deep, was drained with two large rubber tubes, around which iodoform gauze had been wrapped.

Postoperative.—Pulse never higher than 95; temperature never above 101° F., reaching normal on seventeenth day.

Abscess cavity drained with siphon method very satisfactorily, large quantities of yellow thick fluid of foul odor being removed in this way. The cavity closed in rapidly, bile continuing in discharge up to the twentieth day.

Discharged on thirtieth day with sinus one and one-half inches deep.

October 15.—Sinus entirely closed; scar firm. Patient has gained in weight and strength.

FOREIGN BODIES ACCIDENTALLY LEFT IN THE ABDOMINAL CAVITY.

WITH REPORT OF ONE HUNDRED AND FIFTY-FIVE CASES.¹

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It is a surgical axiom that so long as surgery continues as an art, just so long will foreign substances continue to be unintentionally left in the abdominal cavity. While it may seem questionable to say that no amount of carefulness will entirely exclude all possibility of this accident, we have but to study closely the accidents herein recorded, and the manner of their occurrence, to be convinced of the correctness of this statement. In fact, if we study the subject fairly, and admitting that the accident occurs more frequently than the reports casually observed would lead us to believe, it is after all remarkable that they are of such comparatively rare occurrence.

Although the vast majority of operative procedures are deliberately planned and systematically executed, there are numerous occasions where the most carefully devised plans require almost instantaneous revision, testing to the utmost the coolness, clearness, and resourcefulness of the operator. For this reason it is surprising that during such rapid and radical change of plans accidents do not occur more frequently, and the necessity of a thorough organization along simple lines becomes singularly apparent.

The urgency for a more uniform understanding of the rules regulating this accident grows more imperative as we

¹ Read in abstract before the Louisville Surgical Society, June 10, 1901.

realize the frequency of its occurrence. Statistics, although supplying an astonishing number and variety of such accidents, by no means represent the true status of the question. In the preparation of this memoir, instances were observed where the truth was withheld, representing one source of fallacy. Another and greater source of fallacy is represented by the fact that a percentage of our deaths is due to this accident; and the fact is never realized, because the smallest number of deaths are followed by post-mortem investigations.

A careful digest of the appended cases reveals examples illustrating most beautifully the patience and resources of nature in satisfactorily dealing, unaided, with the most difficult problems in connection with the disposal of a foreign substance when left in the abdominal cavity.

In the collection of these cases a number of instances were noted where the presence of the foreign body was recognized directly after, or a very few hours after, the operation. These cases were intentionally withheld from the author's list as not being rightfully entitled to be mentioned as forgotten foreign bodies in the sense in which that expression is usually employed.

The recording of letters was also restricted to those containing the report of a case or some suggestion bearing upon the prevention of the occurrence of this accident. While instances were noted of the suppression of facts, the correspondence as a whole represented a display of courage and frankness that was indeed refreshing.

Pathological Changes.—In studying the pathological changes resulting from the presence of a foreign body in the abdominal cavity, it is interesting to review the experiments of von Büniger "On the Healing of Foreign Bodies under the Influence of Chemical and Microparasitic Irritation." (*Verhandlungen der deutschen Gesellschaft für Chirurgie*, XXIV Congress, 1895. Abstract in *ANNALS OF SURGERY*, xxiii, page 225.)

"*Experiments with Sponge soaked in Turpentine.*—Macroscopically the piece of sponge in the abdomen was found surrounded by a grayish-white capsule in from sixteen to twenty-four hours, fixing it to the peri-

toneum. In its immediate vicinity was a moderate degree of congestion, otherwise there was no change.

"Microscopically the piece of sponge was found encapsulated in numerous layers of fibrin, the holes in the sponge were filled with fibrin, which was especially richly developed near the circumference, and the meshes of which were strewn with small round cells.

"The peritoneum lying near the turpentine sponge looked swollen and injected, the connective-tissue fibres were separated apart from one another, the endothelial cells were broken loose from their places and shoved into the neighboring fibrin layers.

"The distended vessels of the surrounding tissue contained many leucocytes hugging the walls of the vessels and in process of emigration towards the foreign body.

"Within the foreign body most of the exudate cells were more or less degenerated, and presented cells in various states, from those which were intact and perfect to those which were in the last stage of disintegration. Between these were all varieties of intermediary stages. The destruction of the cells became more marked as the turpentine deposits were approached, and when the immediate neighborhood of the same was reached, most of the cells were of a pale gray color, with stainless nuclei, and were bestrewn with vacuoles and much shrunken.

"After two days the turpentine formed no more islands, but the exudate cells pressed in still greater masses towards the inside of the foreign body, and at the same time the fibrin penetrated farther towards the middle of the foreign body.

"The rich growth of young cells occurs not only on the surface of the foreign body, but also penetrates into the cortical portion of the same. By the third day the zone of purulent infiltration has advanced considerably towards the centre of the body, so that the periphery presents the appearance of a clear border. This becomes replaced by loose granulation tissue, which follows immediately after the leucocytes, while still farther towards the periphery older and firmer spindle-cell tissue is found.

"By the fourth day the leucocytes, containing remains of the turpentine and particles of chromatin, have travelled still farther towards the centre. On the periphery the formation of permanent tissue has continued to progress.

"The further development of the young granulation tissue from the fifth to the seventh day goes on in such a manner that the foreign body becomes gradually enclosed in a layer of spindle-cell granulation tissue; and from its periphery it becomes permeated by firm granulation tissue, which, without any sharp dividing line, merges into the neighboring tissue, on the one hand, and into the young loose granulation tissue within, on the other. In a sponge experiment, on the seventh day, the cavities of the foreign body were completely filled, and young, vascular granulation tissue had penetrated to the very interior."

Neugebauer considers the effects of foreign bodies left in the abdominal cavity under four headings, namely,—

(1) Aseptic: if the foreign body is not aseptic. These being of greatest danger to life.

(2) A chemical effect: which does not bear upon the foreign bodies left behind, such as instruments, sponges, etc., but only upon the leaving behind of sutures, iodoform, masses of hydrargyrum soluble (Crede), etc.

(3) A thermic effect: for instance, by the application of hot thermocautery, hot steam, etc.

(4) A pure mechanical: the consequence of which interests us the most when considering foreign bodies in the abdominal cavity, for instance, an artery clamp, a gauze sponge or sponges.

This classification can be simplified by excluding the first three, since the fourth, or mechanical, represents, practically, the whole subject. The experiments of von Büngner are in the main corroborated by clinical evidence. In Noble's case the sponge, after remaining in the cavity a number of weeks, was almost removed through phagocytic action. Another example is Case No. 56, Neugebauer list, where the sponge was disintegrated and the remaining particles discharged in instalments after the lapse of one and one-half years.

The effect of a foreign body in the abdominal cavity depends primarily upon its sterility. If it is not of an aseptic nature a general infection ensues, rapidly terminating the life of the individual. If the foreign body is practically aseptic in its nature, the tendency is, as von Büngner has shown, for it to become enveloped in a capsule of fibrous exudate interspersed with leucocytes. The isolation is still further carried out by adhesions between loops of intestine or between intestine and omentum, or, lastly, by both in conjunction with some other organ or the abdominal parietes. In this isolated state it may remain exposed to phagocytic influence until its final removal is accomplished.

On the other hand, its presence may become a source of irritation with or without attending suppuration. This irritation may terminate with the expulsion of the foreign substance externally through the site of the original operation. If, how-

ever, the wound becomes firmly united throughout, the foreign body commonly finds its way out by eventually forcing an entrance through the least resisting surface, which is usually some portion of the intestinal tract, or, as it has occurred in one instance, into the urinary bladder. If nature is not able

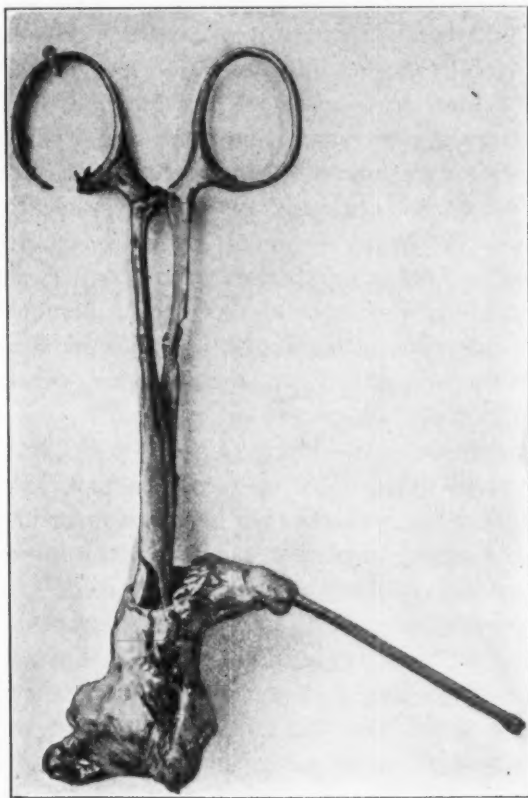


FIG. 1.—Photograph showing point of forceps resting in the dilated appendix vermiformis.

to cope with the foreign body in this manner, art eventually comes to the assistance.

The expulsion of the foreign body by unaided nature is usually accomplished in a gradual manner, but instances are recorded in which this was partially or entirely effected by some sudden movement. In the gradual expulsion, nature

seeks different avenues of exit, finally selecting, with her good judgment, the avenue of least resistance.

An entrance into the alimentary canal, in a gradual way, is accomplished by the foreign body provoking an irritation which terminates in ulceration and perforation of the intestine. The same irritation that is sufficient to excite at one point an ulcerative inflammation determines at other points an inflammation of less degree, resulting in the formation of adhesions about the perforation; so that at the same time that nature is gradually working her way through the intestinal wall she is wisely creating adhesions about the perforation.

In this way the perforation and, in fact, the entire field of operation remains under the control of the exciting forces. The method of entrance into the intestinal cavity can be explained, in some instances, by an ulcerative inflammation, pure and simple, in other instances, by atrophy and degeneration from the effects of pressure, or, what is more common, by the combined action of these two processes.

On the escape of the foreign body into the intestine, the remaining cavity drains itself into the intestinal tract, and the collapse of the walls, with the obliteration of the cavity, ensues, thus representing the usual steps in the spontaneous relief from the foreign substances and their attending evils. A study of the cases indicates that the escape of the foreign body does not always mark the termination of the trouble. The walls of the cavity, through a long-continued inflammatory action, may become more or less rigid and fail to collapse with the evacuation of the foreign substance. The opening in the intestine remaining patulous, faecal matter finds its way into the cavity, representing another form of irritation. This continues until interference becomes necessary to relieve the faecal and purulent accumulation, or for the cure of the faecal fistula, then the accumulation partially empties itself.

Instead of the gradual method of eliminating the foreign substance, its expulsion may be partially or entirely effected through the agency of some accident that may drive the foreign body, such as a clamp or forceps, suddenly through the intestine or some other hollow organ.

When the expulsion is sudden, it is usually the result of some accident, by which force is suddenly applied and the foreign body driven violently against some organ, with the perforation of the same.

The most striking illustration of such an effect is in the case of Kosinski, where two hæmostats were left behind. Later on a second abdominal section was performed for the recovery of the forceps; although the forceps were not recovered, an improvement followed. Some time after the second operation, while in the act of looking after some baggage at the railway station, the patient was seized with great pains, which were followed some time thereafter by a third operation, which resulted in the death of the patient on the table and the finding of the forceps partly within the external iliac artery. (See complete report elsewhere.)

Symptomatology.—In considering the symptomatology of a foreign body in the abdominal cavity, it is well to remember that a foreign substance may remain quiescent in the cavity for years without creating the least disturbance. In fact, a careful study of the recorded cases, together with the well-known action of the phagocytes upon bodies not only in the abdominal cavity but elsewhere in the living organism, and of such a resisting character as ivory pegs, etc., teaches us that nature is able, under the proper conditions, to take care of many of the foreign substances.

Under such circumstances, a disturbance may never ensue, since the removal of the foreign body may be accomplished in a molecular way through phagocytic action. As an illustration of the presence of a foreign body without creating disturbance for a long time, we might refer to Case 97 (Neugebauer), where a sponge passed spontaneously after the lapse of twelve years, and Case No. 45, where forceps wandered about the abdomen for four years, and finally passed spontaneously. Numerous other instances of a similar nature but of a shorter period of time are recorded. The disturbance created by a foreign body in the abdominal cavity is dependent upon various factors: (a) The sterility of the foreign substance. (b) The

size. (c) The character, *e.g.*, regularity of outline, presence of sharp or pointed surfaces. (d) Density. (e) Point of location. (f) Individual tolerance of the peritoneum. (g) Behavior of the individual.

The importance of the sterility of the object has been fully considered in the foregoing lines. The influence of the size of the foreign body is fully realized when we consider that in most abdominal operations some foreign substance is left behind in the form of ligature material, and this with a feeling of confidence that the peritoneum is amply able to care for the same.

The regularity and density apply especially to such foreign substances as instruments, etc. Here we are again forced to review the classical case of Kosinski, where the hæmostats by a sudden movement were violently driven into the iliac artery, causing the death of the subject. The foregoing case likewise illustrates in the most graphic manner the relation of the location of the foreign substance to the extent of damage it is capable of creating.

The difference in the tolerance of the peritoneum in different individuals is too well established to require any further corroboration. And the importance of the rôle that quiet or the opposite conditions may have in preventing or precipitating trouble while a foreign agent occupies the abdominal cavity may be clearly seen.

The symptoms of the presence of a foreign substance may vary from *nil* to those representing the most violent intra-abdominal disturbance.

Pain usually localized in character and of a fairly constant nature. Disturbance of the intestinal peristalsis. Perhaps the presence of a tumor, not infrequently, very movable in its behavior and with outlines characteristic of the missing object.

The recognition of the object has been accomplished by palpation through the rectum, vagina, and even through the abdominal wall. The symptoms of an ileus frequently represent the clinical picture which the case presents. A violent sepsis may promptly ensue, or the case may drag along with

symptoms of more or less pain or a sense of uneasiness, elevation of temperature, emaciation, sweats, and, in fact, the usual course of a mild but protracted form of sepsis.

If we consider, however, the frequency with which symptoms simulate other conditions than those of foreign substances, we can appreciate the difficulty in establishing a clear clinical picture pointing to the presence of a foreign body. This very fact furnishes the most cogent reason for an investigation of any abdominal section presenting obscure symptoms and threatening the existence of the individual. The case of Kosinski also illustrates in the most emphatic manner the disproportion that may exist between the presenting symptoms and the existing condition; since in this case the patient, after showing evidence of an intra-abdominal disturbance and being subjected to a second abdominal section, improved, notwithstanding the fact that the forceps remained hidden in the abdomen.

At the time of her accident all symptoms of the presence of a foreign body had practically disappeared. Interest in the case was revived when the forceps had not only violently forced an entrance into the left external iliac artery, but also occasioned a rupture of the large intestine. Even in the face of this extensive damage, the patient for about two days continued more or less upon her feet.

Although the radiograph did not yield the desired result in Kosinski's case, the difficulty being due to a defective arrangement, much assistance can be expected by resorting to it in these cases.

Prevention.—After reviewing the formidable list of accidents herein tabulated, the truth of the opening lines of this paper must be singularly apparent.

The fallacies attending statistics upon this question have already been pointed out, and to this it is but necessary to add, it is human nature to report some of our accidents that have recovered after an extraordinary course and to withhold those that have terminated unfavorably.

The more closely one is associated with surgery the easier

it is to understand the occurrence of these accidents, and *vice versa*. Of the numerous letters received by the writer, but one correspondent expressed himself as not being able to see why the accident should ever occur.

This accident is like many another thing that we seem unable to understand until some extraordinary circumstance brings about its development, and then, looking backward, instead of forward, it is an easy matter to comprehend its occurrence.

A strong factor favoring the repetition of the accident is that we are frequently obliged to operate not only under various conditions, but we are confronted by circumstances and occasionally by an extraordinary complication, any or all of which factors would tend to a disastrous influence upon any definite system that might have been adopted, and upon the watchfulness that the case should have received.

The writer's own case illustrates this very clearly. The operation was, of necessity, performed in an improvised room; secondly, it was of an unusual nature. Owing to the first circumstance, the usual systematic course was to a certain extent disturbed. Thirdly, when the instruments were returned to the cabinet where they belonged the absence of the clamp was noted, but the patient being without any special symptoms, the subject was dismissed with the idea that it was lost in one of the several buckets of bloody fluid.

The use of hæmostats within the abdominal cavity, which the writer, together with the majority of operators, condemns, were employed in his case out of compulsion. The bleeding points were so numerous that the clamps were insufficient in number to equal the demand. All, together with a loose spacious cavity that remained after a very trying operation, combined to favor the occurrence of the accident.

Among the commonest of the safeguards that have been recommended might be mentioned,—

Special count before and at the close of the operation by a special nurse or assistant, or special count by two nurses or a nurse and assistant.

Tapes or threads attached to pads and instruments within the cavity and with another forceps on the tape or thread external to the cavity.

The avoidance of small sponges, pads, or hæmostats.

The preference for large pads instead of small ones. Suturing of drainage tubes to the wound and the tying together of gauze strips where a number are employed. (Weir.)

The use of the smallest number of sponges, pads, and instruments.

Storing of pads in packages, each package to contain a specific number of the pads.

The use of duplicate glass checks as recommended by Fowler.

The use of a muslin wrapper as suggested by Baldwin.

While the counting and recounting of sponges and pads before and after an operation by one or more individuals should and always will be a most important feature in the avoidance of this accident, yet the cases are numerous where the accident occurred notwithstanding this count by one and even two nurses or assistants.

When the count is made, the individual doing the counting should not point at the sponges and enumerate in a silent manner, but should pick up and put aside each sponge, at the same time calling out its number in a clear, distinct, and audible tone.

The plan of attaching tapes or threads to pads and instruments and using them as "tracers" has received the recommendation of a great number of surgeons. But the fallibility of this scheme is as clearly proven as the former. Not only were the pads lost, but also the tape and the attached forceps.

While many object to this arrangement on the ground of the inconvenience that the tape and forceps create, it will claim many advocates even in the face of this objection and its fallibility.

The force of the suggestion regarding small sponges and pads is apparent. The smaller the object the easier it is to be overlooked, and the more difficult it is to be recovered when

lost. Not only this, but where a large number of intestinal loops are to be held back, this is better accomplished by one large pad than by several small ones. Nevertheless, small pads will never be entirely discarded. It is the opinion of the writer that the tendency towards the use of many small sponges is greater on this side of the Atlantic than on the other, where there seems to be a decided leaning towards the use of a few large sponges.

The suturing of the drainage tube and the tying together of the several gauze strips where many are employed, as is recommended by Weir, is a very practical suggestion, especially if we note the number of times that accidents have attended the use of drainage tubes and gauze drains in the recorded cases.

In restricting ourselves to the smallest number of pads, sponges, and instruments, we adopt a system of simplicity that must appeal to all as one of the most important elements in the avoidance of this accident.

It is to be deplored that in many hospitals where nurses and assistants are plentiful that everything seems to be conducted in the most complex manner, which at once creates the effect of complexity rather than that of simplicity.

The development of surgery should carry with it the idea of simplicity, and the closer we conduct our operations along simple lines, the fewer accidents, infections, and complications will be met.

The storing of sponges in packages of a definite number, the glass checks as recommended by Fowler, or the wrapper as suggested by Baldwin, contribute in a way to the safety of the method, but will hardly meet with any general adoption.

Dr. Howard A. Kelly, "Foreign Bodies in the Abdomen after Operations" (*New York Medical Journal*, March 24, 1900), suggests a rack for the reception of soiled sponges and pads. See accompanying figure.

After all, we are forced to the conclusion that the real factor in the avoidance of this accident is the recognition of system, simplicity, and watchfulness to the most exacting degree.

At the bottom of most of these accidents we find a diverted attention, a defective system, or a dangerous degree of complexity.

It is true that one or more of these defects might exist, and with ample excuse for this existence, but we can only hope to reduce these accidents by the observance of the highest degree of simplicity, system, and watchfulness; and while every operator will work out a method that appeals especially to his judgment, that method will be most effectual, provided

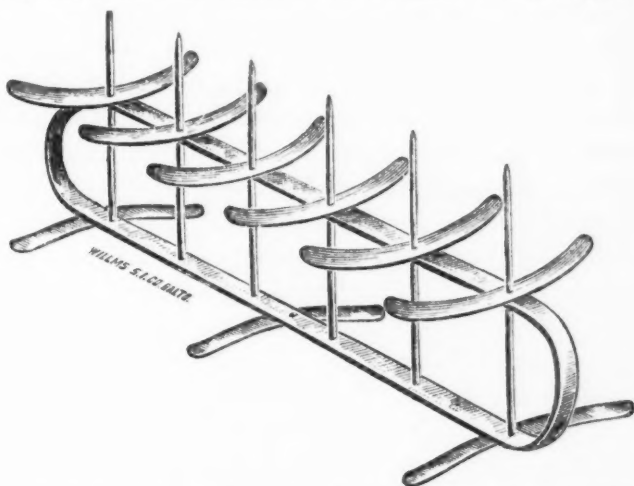


FIG. 2.—Rack for gauze and sponges discarded during an operation. The gauze is hung over the flat horizontal strips and the sponges are spiked on the points. There is room for twelve pieces of gauze and six sponges. (H. A. Kelly.)

the cardinal elements underlying that method are those just enumerated.

It is the hope of the writer to further this end by exposing the frequency of this accident by the following imperfect lists, and thereby to create a degree of vigilance that shall beget a more uniform standard of accuracy against this accident.

Medicolegal.—One of the most interesting phases of this subject is fixing the responsibility upon the proper person, if there is any responsibility to be fixed. A number of suits have been instituted in different parts of the world against the oper-

ator as the responsible person for the occurrence of this accident. So far as the writer has been able to learn, all suits resulted in the acquittal of the accused. In the United States, one or two suits against the surgeon have been withdrawn and a new suit filed against the institution in which the operation was performed.

Perhaps the most notable case of this kind is the oft referred to case of Kosinski, a brief report of which is appended. In this suit both the operator and the owner of the Infirmary, who was likewise a surgeon, were sued. This suit, as others, ended in a victory for both the accused.

Dr. Baldwin, of Columbus, Ohio, was made a defendant in such a suit, which was finally withdrawn and another entered against the hospital on account of the failure of all past efforts that have been directed against the surgeon.

Dr. Baldwin has made a fairly comprehensive canvass of the opinions of other surgeons of the question regulating the responsibility of the count of sponges in surgical operations. The consensus of these opinions was uniformly in favor of holding the nurse responsible. It was the expressed opinion that if the surgeon, at the close of the operation, asked for a count of sponges, and this was made, and assurance given him that all sponges and pads were present, that his responsibility ceased.

It was neither prudent nor fair that he should leave his, the most important, post in order to do duty that justly belonged to the nurse. That such a course would be far more disastrous in the long run than that of trusting to the nurse or assistant, as has been the method in the past.

There might be a tendency by some to hold the surgeon responsible for everything about the operation, in keeping with well-recognized rules of holding the principal responsible for his agent's acts. While in a way the surgeon is somewhat responsible for the conduct of the whole operation, and especially so where he operates in an environment created by himself and controlled by him, yet his responsibility has a limit.

To make a sweeping statement that the operator must

hold himself, and no one else, responsible for what occurs during the operation is using an expression that is lacking in reason and equity. We are all at times obliged to operate in an environment totally unsuited for any operative procedure, and to accept assistance that we know is manifestly incompetent. But we have no choice to do otherwise, or, more properly, to do nothing because the conditions are not as they should be would be sacrificing chances that justly belong to every human being, and would more likely terminate in disaster than to make the best of the confronting difficulties.

However we may feel, we are obliged to conclude that to a certain extent the surgeon is responsible, and after that the responsibility must rest elsewhere, and not with the operator. It will be impossible to formulate hard and fast rules regulating all cases. Each case will be required to be decided upon its own merits, and the responsibility fixed accordingly.

The making of the sweeping statement already referred to cannot possibly fail to incriminate in its meshes some innocent victim. Perhaps the most reasonable expression is that of Sanger, of Leipzig (see Neugebauer's list), who declared that there were risks that the patient had to assume, and could not rightfully look to any one else.

If the case involved details that made it impossible for the attendants to cope with it, it is clear to see the injustice of expecting the operator to assume responsibility that rightfully belonged to the assistants, or that happened to be the misfortune of the individual.

In other vocations it is reasonable to assume that, unless properly prepared, one should not act; in surgery one is occasionally compelled to act, even though it is known that he is not prepared, and in these conditions to adopt any other course than that would be attended with the loss of more lives than if he did not make the best of the circumstances.

Epitome of the Suit against Professor Kosinski and Dr. Solomon.
Translated from an extended German account.

A suit was brought against Professor Kosinski and Dr. Solomon for leaving two artery clamps in the abdominal cavity, in consequence of which the patient died in several months' time.

The case was as follows: On the 22d of December, 1897, Professor Kosinski performed an abdominal section in the private clinic of Dr. Solomon upon a patient fifty years of age for an ovarian cystoma with a twisted pedicle. Kosinski had known and treated the patient two years. Dr. Zembrzusi administered chloroform and Wawrowski took charge of the instruments and sponges. The operation was very difficult on account of the numerous adhesions and an interrupted narcosis. A great many ligatures were necessary, as the other ovary had degenerated and its removal became necessary.

After the first few days an elevation of temperature occurred, accompanied with abdominal pains and pains in one leg. An inflammatory infiltrate was felt. By this time it was discovered that two artery clamps were missing from the instrument cabinet. It was thought that the artery clamps might have been taken by Dr. Solomon, as he left shortly after this operation to perform another in one of the provinces. Nevertheless the coincidence of an inflammatory infiltrate, and the absence of artery clamps aroused the suspicion of Dr. Kosinski that perhaps the missing clamps had been left in the abdomen.

Consequently, six weeks after the abdominal section, he re-opened the abdomen to investigate the infiltrate, but found neither pus nor the missing clamps. His suspicions were not allayed. However, he concluded to wait for further developments. The condition of the patient considerably improved after the second abdominal section, although there remained a fistula, which finally closed.

The patient left the hospital and was treated by Dr. Zembrzusi. Several weeks passed, but as the convalescence seemed to be retarded, Dr. Kosinski was again called for a more thorough examination. On this occasion he felt a hard resistance in the region of the umbilicus. Per rectum and per vaginam there was nothing to be felt. His former suspicions were renewed, and he expressed his suspicion through Dr. Solomon to the family that perhaps the hæmostats that were missing from the cabinet were left in the abdominal cavity.

Professor Kosinski insisted that another operation be undertaken and offered to perform the same gratis. The patient had agreed, and a room was prepared for her, but she failed to appear. The family physician had informed her two sons of the nature of the operation, to which they failed to give their consent, as they stated they had lost all confidence in Professor Kosinski. This was in the beginning of May. The sons of the patient called in another surgeon, Dr. Sawicki, without informing him of the suspicion of Professor Kosinski. Dr. Sawicki found an inflammatory infiltrate, but not knowing of the possible presence of the forceps saw no reason to perform an operation, and Professor Wassiljew and Dr. Krajewski, who were called to consultation, were of the same opinion.

Dr. Krajewski felt an infiltrate in the left parametrium and advised the patient to remain for further observation. He also suggested, in case of an operation, to consult Professor Kosinski, who had operated upon the patient before. Dr. Sawicki demanded a consultation with Professor Kosinski, to which the sons would not agree.

The patient was sent to the health resort Ciechocinek with the view of promoting the absorption of the inflammatory exudate. She improved to such an extent that when her sons told her of the suspicion of Dr. Kosinski, she would not believe it and ridiculed the idea.

On the evening of 24th of June, 1898, the patient arrived at Warsaw from Ciechocinek. Before the arrival at the station she reached up to get some baggage, and at the same moment she felt herself suddenly becoming faint. The momentary shock soon passed, and on reaching home she entertained her sons until late at night. On the following morning she felt extremely weak, and Dr. Frankel was called in, who demanded immediate operation by Professor Kosinski, and told her sons that no time should be lost. They refused to call Dr. Kosinski, but called in Professor Wassiljew. The latter saw the exhausted patient about mid-day and was told of the suspicion of Dr. Kosinski. In spite of the fact that the patient had passed in all a vessel full of blood-clots, the professor suggested that a radiograph be prepared, and the patient was removed in a *droski* to the infirmary of Dr. Bychowski, where she was led up three steps and remained several hours. Several radiographs were made, but with negative results. The exhausted patient was taken to her home late at night and the following morning Dr. Wassiljew assisted by Dr. Krejewski performed the abdominal section in the private infirmary of Dr. Wawelberg. Partial narcosis followed. The patient became almost pulseless. The Douglas pouch was found covered by inflammatory bands. A second oblique incision was made above Poupart's ligament, hoping to reach the seat of disturbance extraperitoneally. A large cavity was opened in which both hæmostats were discovered lying parallel and just above the pelvic brim. Both forceps had forced an entrance into the left external iliac artery. The removal of the forceps was attended with a furious hæmorrhage, which the operator endeavored to control by compressing the aorta. The cavity was tamponed. The patient died upon the table.

The ends of the forceps had punctured the left external iliac artery when the patient reached up to get her baggage at the railway station. A false traumatic aneurism ensued as the autopsy showed. The lower end of the forceps perforated the large intestine, and this accounted for the blood passing from the injured artery by way of the rectum. Had the operation been performed when the patient left the railway carriage, or even on the following morning as the family physician had requested, perhaps there would have been a recovery.

The patient, who was suffering from an injured artery, was driven in a carriage to her home; from there to an infirmary, then marched up three steps to have a radioscopic examination made with unsatisfactory result: as it appears owing to imperfections in connection with the outfit. After this unsuccessful attempt another twenty hours had elapsed before the operation was performed.

The trial lasted four days. There were six experts, two to judge the pathological-anatomical side, Professor Przewoski and Troickij, who had made the post-mortem examination.

Dr. Krajewski undertook the description of a modern laparotomy.

Dr. Maksimow undertook the criticism of the latter as it was performed in this case.

Neugebauer supplied the statistics that were liable to be called upon in the controversy. Professor Pawlow, of St. Petersburg, undertook to depict what is called a *cœliotomy* and the complications and mistakes that are liable to occur.

Summary.—The direct cause of death in this case was the perforation of the artery by means of the foreign body. The indirect cause, the refusal of the sons to comply with the request for another abdominal section by Dr. Kosinski; and the loss of time that arose from the trip to Ciechocinek.

The trial ended in the acquittal of the accused.

For the purpose of securing as full information as possible on the subject under study, I wrote to a large number of surgeons whose opportunities for observation in abdominal surgery were known to be large, asking for reports of any such accidents known to them, and for any special suggestions that might tend to aid as safeguards against such accidents in the future. From the replies to my letters, I have selected for publication the following, as of special value.

I.—In 765 laparotomies, I have left a piece of gauze twice and forceps once. All three of these patients recovered. In the last case I was operating upon a suppurative appendicitis, a pus cavity was opened in the pelvis, and at the same moment the free peritoneal cavity was opened; a small gauze sponge was left in the bottom of this abscess cavity, and the perforated appendix was removed. The wound was partly closed. After a stormy convalescence the sponge worked its way to the surface and was removed from the drainage tract three weeks after the operation.

ARCHIBALD MACLAREN.

II.—I had only once the misfortune of leaving a foreign body in the abdominal cavity after laparotomy. It was a small iodoform packing, that slipped away during a rather stormy colotomy for inoperable cancer, made so by an extremely unsatisfactory anæsthesia, and remained in the abdomen. As there had been much fever before the operation, and the local symptoms caused by the foreign body were not very distinct, the cause of the slow peritonitis remained unexplained till the autopsy revealed the actual facts.

ARPAD G. GERSTER.

III.—In very nearly 2000 laparotomies, I have had but two such instances. In one I left a hæmostat, but discovered it within an hour, and took it out before the patient had entirely come out from the anæsthetic. The other instance—quite recently—was one in which I left a large flat sponge over night, and took it out the next morning without doing the patient any harm.

I know of three cases in Buffalo where gauze pads had been left in. Two of the patients died, though I cannot say that they died from the effects of the gauze pad; while in the other it was discharged through the abdominal wall at the site of the primary incision, some months after the operation, the patient recovering.

MATTHEW D. MANN.

IV.—With regard to your inquiry relating to foreign bodies in the abdominal cavity after operation, I can furnish you with the report of one case. The accident occurred last winter after an operation for a large fibroid. When the abdominal incision was being sutured I placed a medium-sized gauze sponge over the intestine to facilitate the introduction of the sutures and press the bowels back. I do not know how it happened, but the sponge was not removed. The patient did very well, with very little temperature. The sutures were removed on the tenth day. The union was perfect. About the fourteenth day a swelling occurred in a localized portion of the incision which was opened; suppuration continuing. I directed my assistant to enlarge the opening with a view to better drainage and treatment, after doing which he noticed the sponge, which he removed. The patient recovered, but suppuration continued for two weeks longer. If I have ever left any foreign body in the abdomen I do not know, as the cases upon which autopsies were held did not show it.

E. LEWIS.

V.—I know of only two cases in which materials were allowed to remain in the peritoneal cavity after operation. In one there were two laparotomy sponges allowed to remain, and in the other there was left a large fragment of gauze. I know of two other cases in operating on the neck where two small pieces of gauze were left, and still another in an amputation of the breast, the latter in the practice of your humble servant. It was used for compression over a small vein, the suturing continued and the gauze overlooked. Putting a considerable string of tape on the sponges and also using forceps on them, I think, lessens the liability of leaving them in the peritoneal cavity. The great danger is in the use of small sponges because of their number, but fortunately they are not much used in the peritoneal cavity. Counting the sponges has saved me on one or two occasions, as I felt certain the sponge was not in the abdominal cavity; but the count showed that it was absent, and after a thorough search it was located.

J. B. MURPHY.

VI.—I have never left any foreign body in the abdominal cavity. Twice my assistants have left portions of iodoform gauze in the pelvis after vaginal operation, and once the same thing happened to me. I try to avoid leaving in pads, etc., by having a long string attached to the smaller ones; *and I never allow any one but myself to either introduce or remove foreign bodies, such as pads and instruments.*

WM. R. PRYOR.

VII.—In upward of 1300 abdominal sections, so far as I know, there has been but one foreign body left in the peritoneal cavity. This was a sea-sponge, which was left in the uterovesical pouch. The patient made an uncomplicated recovery from the operation and returned home. Some weeks later she developed inflammatory symptoms, and had what was supposed to be an abscess anterior to the uterus. The abdomen was reopened, and the cause of the inflammation was found to be a sponge. The leucocytes had almost entirely disintegrated the sponge, very little of which remained. I am quite sure, had nothing been done, that the entire sponge would have been absorbed, and the patient would have made a permanent recovery.

It is my custom to make one of the assistants responsible for the sponge and gauze count. This is his responsibility and not mine. I believe this to be the best practice, as in the hurry of operating in the graver cases I feel certain that the surgeon would be more apt to make mistakes than is the assistant, who has not the responsibility of the operation on his mind.

CHARLES NOBLE.

VIII.—I have had but one experience in leaving foreign bodies in the abdominal cavity. It was in the first abdominal section which I ever performed, some fifteen years ago. I was assisted by an older surgeon, who, during the operation, tore one of the sponges in half and tucked a half between the bladder and uterus without saying anything to me about it. The woman died of shock, and the sponge was removed at the post-mortem, much to my surprise, as a count of the sponges gave the number with which we had begun. This was in the days before the use of gauze pads. This experience early in my career has made me, I think, more careful than I might have been, and I am glad to say I have not had another such experience since.

B. C. HIRST.

IX.—In answer to your letter, I know of a case occurring in a hospital with which I was connected where not only a gauze pad but a clamp attached to it was left in the abdominal cavity.

Personally I have had no cases, and I probably have avoided having a case because I know every pad placed in the abdomen in my cases. To me no device can equal one's own attention to this detail of the operation.

FRANK HARTLEY.

X.—I have had two unfortunate experiences in regard to foreign bodies remaining in the abdominal cavity, one occurring a few years ago when using the old-fashioned sponges, the patient dying from general peritonitis. One occurred about three years ago, in a case of extensive carcinoma of the uterus, and in which a small gauze sponge was left, the patient making a good recovery; but on a reappearance of the disease a year after, the sponge was found on exploration. This is an accident greatly to be regretted. I have always been fortunate in reference to

forceps and instruments, and the first case to which I have referred I had trusted entirely to my assistant, who assured me all the sponges were accounted for. After the death of the patient, and on making an autopsy, you can imagine my sorrow and chagrin in finding a small sponge in the abdominal cavity. Had I relied upon looking after the sponges myself, or trusted to my operating-room nurse, it is not at all likely the accident would have happened. In the second case I do not think we were so much at fault, for the growth was very adherent; the operation was a severe one, much bleeding, and a good deal of sponging necessary; but here again I was deceived by the report of my operating-room nurse.

A. VANDERVEER.

XI.—I have one case to add to your list, one which I have already somewhere reported, possibly in connection with a similar request. I do not think that I have myself separately published it. This must have been about twenty years ago. It was a sponge about the size of a small hen's egg lost in the abdominal cavity, and due to the kind assistance of a visiting surgeon. A prominent operator from one of the large Eastern cities being present, I asked him to assist me, as was then so frequently the custom, and, in order to give him a good opportunity of witnessing the operation, placed him, as my chief assistant, opposite me. The operation for one of the large old-time ovarian cysts was very bloody, one with many adhesions, and many vessels were ligated, much sponging was necessary; his hands were frequently in the abdominal cavity. I did not feel at liberty to speak to him quite as I should have done to my usual assistant. Before closing the wound, the customary sponge count was called for and showed one missing; a thorough search of the room failed to reveal it. I then searched the abdominal cavity, as *I thought, most thoroughly*; in the mean time every assistant, and there were many, as was then the custom, expressed his views, and it was decided that this was the sponge which had been dropped during the process of cleaning, the passing of it into a tub which one of the sisters had emptied into the waste. The incident was recalled by several, and seemed confirmed by my vain search of the abdominal cavity. Peritonitis promptly followed, not altogether unusual at that time, and the post-mortem four days later revealed the sponge thoroughly concealed in the upper part of the cavity, a little below the transverse colon.

GEO. J. ENGELMAN.

XII.—I have left three gauze pads in the cavity, and all the cases have been reported in the *Transactions of the New York Obstetrical Society*. I have now adopted the stringent rule to allow no pad to be placed in the cavity unless it has a tape secured by a pair of forceps. Pads are sterilized in bundles of a dozen, and each set is accounted for while the next one is being used. The operating-room nurse keeps watch of every pad as it is introduced and withdrawn, and counts and recounts the whole number at the close of the operation. Personally I believe that the only way to avoid this accident is to use only two or three large pads

to hold back the intestines, and under no circumstance to allow others to remain within the pelvis even for a minute, unless held in the hand or a sponge-holder.

My patients all recovered after removal of pads through abdominal wound.

H. C. COE.

XIII.—Personally, I can contribute one case of suppurating appendicitis in which I forgot a strip of iodoform gauze pack, which remained buried in the granulations and was finally covered over entirely, and would never have been removed had not the patient returned six months after with a suppurating sinus in the wound, which upon exploration led to the discovery of the gauze. The sinus, of course, healed up immediately after the removal of the gauze.

R. MATAS.

XIV.—In over 3000 abdominal operations, I have had the misfortune to leave behind in the peritoneal cavity a gauze pad upon three occasions. This was due to a miscount on the part of the operating-room nursing force. In the first two cases the count was made by but one nurse. I endeavored to prevent this by making two nurses responsible for the count. Under this plan it again occurred, after which a third nurse was added to those who made the count. Since this was done I have not met with the accident. The pads are placed in packages of six each, and these packages are checked off by two nurses in addition to the one who makes up the original packages. After sterilization, the sponge-nurse counts the pads as the packages are supplied to her, and this constitutes an additional check.

I have designed a system of glass checks with numbers on them. Both checks are attached to the pad by a tape, and when the pad is passed to the operator one check is removed and placed in the basin from which the pad is taken, the other remaining attached to the pad. At the end of the operation the checks must balance each other. The only objection to this is the delay which it entails in passing sponges and the expense of the glass checks, which will have to be made in separate moulds on account of the numbers, or else engraved, if but one mould is used.

G. R. FOWLER.

XV.—I have three times left foreign bodies in the abdominal cavity. One was a sponge and the other two gauze pads. The first resulted fatally, whether from the sponge alone or from the general peritonitis of appendicular origin which demanded the operation, I cannot say. The other two patients recovered from the mishap, one five days after the operation, the other five months afterwards, showing again the comparative innocuousness of sterilized pads. These all occurred prior to 1898, up to which time I, in common with many others, relied on the counting of sponges and pads before and after the operation. In my fatal case, the sponges were counted, as just stated, by my assistant, who was then a sur-

geon in St. Luke's Hospital. In the other cases, the counting was relied upon at the hands of men who have since become distinguished in their profession. Since, however, I attach clamps, or, latterly, halter rings, to all pads going into the abdomen, and limit such to a given number, six, a dozen, or two dozen, I have had no mishap. I have had to take out sponges in two cases of emergency and in the absence of one well-known surgeon attendant. Each terminated fatally. I consider it almost impossible to guard against this contingency absolutely. We can only by great care reduce them to a minimum. In the use of gauze drains, if multiple, I prefer always to tie them together, also to suture drainage tubes to the edge of the wound, etc.

ROBERT E. WEIR.

XVI.—I have never had the misfortune to leave a foreign body in the abdominal cavity. I have studiously avoided commenting on such an accident for fear that it might happen to me at any time. It is a thing so easily done. I have once been called to a case in which a gauze sponge was left in the cavity. The operator in this case was very much hurried on account of the bad effects of anaesthesia, and relying upon his nurse, who counted out his sponges, closed the abdomen with a sponge in it. For the first ten days after the operation the patient did well; then a localized peritonitis developed, and a swelling occurred near the umbilicus, and, finally, an abscess ruptured there. It was discovered that this abscess connected with the intestine, and a faecal fistula was the consequence. The woman's health declined so rapidly that it was deemed necessary to repair the fistula. I undertook this, and found an extremely large opening in the small intestine, involving more than half the circumference of the gut. A rapid end-to-end anastomosis was made with the Murphy button and the abdomen closed, the fistulous tract having been dissected out. I was convinced that a foreign body had been left in the abdomen, and, getting no history of its expulsion, I made a digital examination of the rectum and found a large gauze pad and extracted it. This patient died from exhaustion a few days after the operation.

GEORGE BEN JOHNSON.

XVII.—I have had but one experience of a foreign body left in the abdominal cavity after an abdominal operation, and that was after the enucleation of a large sarcoma of the kidney by lateral laparotomy. The tumor projected through the left anterior abdominal wall, hence I chose this site for operation. Both appendages and uterus had been removed for fibroids of the latter several years before. The pedicle ligature slipped, the tissue being diseased; and while I turned to grasp a clamp to check the profuse hæmorrhage, at the same time compressing the pedicle with my left hand, my assistant, unknown to me, crowded a large towel, one by two feet, into the deep pocket left after the enucleation of the kidney. I again tied off the pedicle, mopped out the cavity of the wound without noticing the towel, which my assistant forgot to mention, and not until some four weeks later did I discover the towel

during an examination made by me personally to ascertain why the wound did not close. All dressings since the operation had been made by the house surgeon. I removed the towel, which was perfectly fresh and sweet, and the wound then healed rapidly.

PAUL F. MUNDE.

XVIII.—I have always been in fear of leaving a foreign substance in the abdomen, but so far I have escaped such mishap. Professor von Nussbaum left a pair of scissors in the abdomen; his patient recovered, and the foreign substance caused no symptoms until months later he experienced pain in the region of the umbilicus when dancing. An incision was made later and the scissors removed. No further difficulty.

N. SENN.

XIX.—Twice I have left a gauze pad. I recovered these before the patient recovered from the anæsthetic. Both patients did well. I have put in hundreds of gauze coffer-dams and gauze packs, and as yet no accidents have resulted. I have prevented accidents by adopting the highest degree of simplicity, but few assistants and but few nurses, the operator, assistants, and nurse counting and knowing just what was to be used in each operation. The count was repeated before closing wounds. The operating-room should not be a storage-room for all operative materials, instruments, and surgical supplies.

JOSEPH PRICE.

XX.—I so far have but one case of foreign body left in the abdominal cavity at operation to report; this was a sponge, ten years ago. It came about through dividing a large sponge in order to get two small pieces, and at the final count the nurse failed to remember the division. The only suggestion that I can make is a rigid registration by two people—the nurse and the first assistant—of the instruments and sponges, the nurse recording the sponges, and the first assistant the instruments, both to be checked by careful inquiry upon the part of the operator just before the abdominal wound is closed.

WM. K. POLK.

(To be continued.)

THE WORSTED TRUSS IN INGUINAL HERNIA.

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THE treatment of inguinal hernia in infants and young children presents quite a different problem from that in adults. A full-grown man has one of two methods open to him. He may submit to an operation and be cured, or he may wear a truss with the prospect—for the percentage of cures is small—of carrying it with him to his grave. His tissues have ceased to grow, and the only change in them is that incident to wear and repair. A truss doubtless will keep his hernia back, but to cure it there must be something more than a lack of recurrence, namely, a narrowing of the inguinal canal and rings. To accomplish this, does it not seem that the ratio between wear and repair of these structures must be changed somewhat, and that a process of growth must be put in motion which at this period of life is somewhat out of time?

Now turn to the infant with an inguinal hernia. The same two forms of treatment are offered, an operative or a mechanical method. The operation, as in the adult, is to radically cure. The truss treatment, however, offers to the infant a somewhat greater hope of cure than to the adult, because of the active growth of the baby. In him the tissues are normally building in excess of the wear and tear; hence the probability, provided the hernia can be kept reduced, is greater that the rings will close and a cure result.

The feeling in Boston is, I think, that a truss of worsted is as effective as a more elaborate one, and that if a cure is to result from truss treatment, it is as likely to follow the wear-

ing of this form as that of any other. All the cases of hernia which I have been able to look up at the Infants' Hospital were given trial with the worsted truss, and in no case where this failed did any other succeed. The paper is therefore reduced to a consideration of the efficacy of the worsted truss.

The worsted truss has certain definite advantages over other forms of truss. It is very cheap, and when soiled can be changed. The soiled one can be washed, and is then ready for use again. A skein can be washed a number of times, I think, without injury. When it loses its elasticity, however, its usefulness is gone. The truss can be worn in the bath. It is less likely to irritate the skin than a spring truss.

Worsted is ordinarily sold in a skein made up of two laps. A lap, or half of a skein, is sufficient for a truss, and the other half can be kept in reserve to be used when the first is soiled. The method of application is as follows: the child is placed on his back, the half-skein is passed under him and pulled far enough so that the end just reaches the internal ring. The other end is then passed through the loop of this first end and the hernia is reduced. The bunch of worsted made by the looping of one end through the other is adjusted carefully and firmly over the hernial opening, and the free end then passed under the leg and fastened by a bit of bandage to the part on the back. If the skein is so long that there is a mass of extra worsted in the back where the perineal arm fastens to the horizontal part, a neater and more comfortable truss can be made by rewinding the worsted, making it the proper length. The truss should fit snugly, and should be worn at night as well as during the day. Whenever it is to be changed, the child should lie down. Occasionally the skin of the groin becomes chafed. This can be guarded against and prevented, I believe, in most of the cases by keeping the parts dry and by changing the worsted as often as it becomes soiled by urine or dejections. The success of the truss depends entirely on the intelligence of the mother and the care with which she carries out her detailed instructions. She must have an ever-watchful eye on the truss, and readjust it as frequently as it becomes loose.

The length of time that a truss must be worn to cause a cure varies with the various writers. Kocher says that if during the first months of life the hernia can be kept back for a matter of weeks a cure is brought about, and that if the child is over six months the truss must be worn from three to twelve months. Coley considers that the truss has not had a fair trial unless it has been worn one or two years. He prefers a spring truss, and considers that about two-thirds of the cases are cured by it.

A cure may be prevented, no matter what the treatment, conservative or radical, by the presence of a phimosis which may cause so much straining that neither the truss nor the cicatrix will hold the rupture.

The contraindications to the application of a truss are few. The presence of an undescended testicle in the canal is a contraindication, for the pressure of a truss would probably be sufficient to prevent the subsequent descent of the testicle or injure it. The presence of a reducible hydrocele is considered by some to indicate the uselessness of applying a truss because of the persistence of a foetal condition, though it is conceivable to me that the processus vaginalis might gradually close if the hernia were kept back.

The frequency of inguinal hernia in children can be accounted for by the following observations taken from an article by Kocher on hernia. The processus vaginalis, which is the process of peritoneum reaching down from the abdominal cavity into the scrotum, in seventy new-born children was not completely closed on both sides in thirty-four cases, on the right alone in fourteen and on the left in eight. In another series of 100 children taken during the first three months of life, the process was found open thirty-seven times. In a third series, composed of 188 children up to nine years of age, there was incomplete obliteration eleven times on both sides, sixteen on the right, fourteen on the left, and there was complete permeability eight times on both sides, five times on the right and five times on the left.

I have been able to trace seventeen cases of inguinal her-

nia occurring in the Out-Patient Department of the Infants' Hospital. Truss treatment cured six of these, and in eleven it proved unsatisfactory. In these eleven failures the truss was tried long enough to prove its inefficiency, and not till then was operation advised. The six cases which were cured had as an average age forty-nine weeks, the individual ages varying from eight weeks to two and one-third years. A truss was worn from six months to two years and two months before it was discarded. The trusses were omitted two months, eight months, one year (two cases), two years, three years ago, and there has been no recurrence. The eleven cases where operation was advised after a trial of the truss averaged in age two years and seven weeks, the variations being from two months to seven years. By comparing the two sets, it will be noticed that the cures occurred in much younger children than the failures; of the cures only one was over two years, 16 $\frac{2}{3}$ per cent., and of the failures five, or 45 per cent.

One case of recurrence was found. A girl of six years wore a truss for six months, and then discarded it two years ago. Now the hernia is reappearing.

No definite conclusions can be drawn from these cases, as they are far too few; yet the result of a study of them is at least suggestive. An inguinal hernia in a child of two years or under can probably be cured by a truss, even though at first it seems to hold the rupture only fairly well; whereas in a child of over two years the prognosis as to a cure from truss treatment is rather poor. If the truss controls the hernia, it should be worn for six to twelve months, according to the age of the child, the size of the hernia, etc., before it is discarded, for fear of recurrence.

PNEUMOCOCCUS ARTHRITIS, PRIMARY IN THE KNEE-JOINT.

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Of the pus organisms which cause suppuration in various joints, the pneumococcus is especially rare. A considerable number of infections due to this cause have, however, been reported. In the great majority of cases infection of the joint has been associated with pneumonia. The subject has been carefully considered in an article by Cave, in the London *Lancet* for January 12, 1901. In this article he tabulates thirty-one cases, all of them reported by foreign observers. The number of cases of primary infection of joints by the pneumococcus, however, so far as his table is concerned, is limited to three. After a careful search of the literature at our disposal, we have failed to find other cases. It is for this reason that the present case is reported as being one of rarity and very great interest.

The history is as follows: H. M. G.; female; surgical number, 561; aged forty years; single; nullipara. No history of any specific infection. General history negative. Patient entered hospital January 24, 1899. So far as her history, previous to admission to the hospital, could be obtained, it was as follows. The patient, three or four days previous to admission to the hospital, complained of sharp pains, or "cramps," as she called

them, in the abdomen. It was for these her physician, Dr. John B. Darby, was called. The day following she complained of pain in the left knee-joint, and for this the patient was given salicylate of sodium. The next day the pain decreased to such a degree that she attempted to get about on crutches. The day following, however, the pain increased, and by the advice of her physician she came to the hospital, not because the case was thought to be an especially serious one, but because the facilities for her care at home were inadequate.

Upon examining the patient the morning after her admission, about four days after the beginning of her abdominal pain, the suspicion arose that the swollen knee might have had its origin from gonorrhœal infection, and the question was asked if she had had any vaginal discharge. This so angered the patient that she refused to answer any further questions, thus rendering the securing of a complete history impossible.

Physical Examination.—Patient five feet six inches in height. Weight, 130 pounds. Nutrition fair. Her face, however, bore an anxious expression. The pulse was 110, rhythmic, and of fair volume. The heart was normal. Examination of the lungs showed on percussion slight variation between the two apices. The right infraclavicular space gave a slightly higher pitched note than the left. On auscultation there was some diminution of the respiratory murmur in the right supraclavicular region, while the infraclavicular region on the same side showed an increased vocal fremitus. The remainder of the examination was negative. The urine showed a slight amount of mucus, but was otherwise normal. The leucocytes numbered 27,000 to the cubic millimetre. On January 25, the morning after admission, an examination of the joint showed it to be markedly distended and very tense. It appeared somewhat congested and was tender to the touch. The temperature on the 24th was 101.4° F., but the next morning it had fallen to 98.4° F. The slightest motion caused great pain. The knee was at once explored with an aspirator and found to be filled with a thick, yellowish pus. It was decided to operate at once. After anæsthetizing the patient and rendering the knee as nearly aseptic as possible, the knee-joint was laid open by two incisions on either side of the patella, extending from the top of the joint down to the upper extremity of the tibia. Two other incisions

were made posterior to the lateral ligaments, so as to lay open the posterior portion of the joint, and thus secure complete drainage and irrigation. The joint was cleansed as completely as it is possible to cleanse a knee-joint, every part of it being exposed and washed out. Strips of sterile gauze were carried through the joint in every direction, packing it well open and affording the most complete and perfect drainage, together with an opportunity for irrigation. That evening the temperature rose to 100.8° F. It fell two degrees on the morning of January 26, but rose to 103.2° F. on the afternoon of January 27. On the afternoon of January 26 the patient became delirious, the delirium continuing until the morning of the 27th. The patient's condition was such as seemingly to demand immediate amputation, and this was performed at 10 A.M. on January 27. A circular amputation was made at about the junction of the lower and middle thirds of the thigh, well above the joint. The divided tissues were very carefully inspected, to see if there was any evidence of infection running up the thigh. Particular attention was paid to the tissues surrounding the femoral vessels. The amputation seemed, however, to be made through perfectly normal tissue, and it was therefore hoped that all infection had been removed. A circular amputation was performed, ample room being left at either extremity of the united stump for the exit of strips of iodoform gauze used for drainage. On the morning following the operation the temperature fell to 100.2° F., and the pulse, which at the time of operation had reached 156, had fallen to 120. At 12.40 on the day of operation the patient was given a saline infusion of 600 cubic centimetres. Another infusion of 500 cubic centimetres was given at 5 P.M., and a third of 475 cubic centimetres at 10 P.M. The patient rallied from the shock of the operation, and on the following morning the pulse was 120 and the temperature 100.4° F. The patient seemed to be comfortable and the delirium had disappeared. The patient was carefully stimulated and took her nutrition fairly well.

On February 3 two stitches and the gauze packing were removed from the incision, and about two ounces of seropurulent fluid escaped. The tissues were unhealthy in appearance, the blood count was 27,000 leucocytes to the cubic millimetre. The wound was ordered flushed with boracic acid solution. The temperature ranged from 100° to 101° F. from January 25 to Feb-

ruary 2. From that time it began to rise. At 2 P.M. of February 3 the temperature reached 105.5° F., the next morning at eight o'clock it was down to 101° F., but at 11 A.M. rose to 104.8° F. Associated with the high temperature on both of these days, viz., the 3d and 4th, there was a chill. From this time on the temperature gradually rose until before death on February 6, when it reached 108.2° F. The pulse, which varied considerably from time to time, also averaged very high, ranging during the last two days from 130 to 160. During the last day there was delirium and involuntary micturition.

Bacteriology.—Coverslip preparations of the purulent material taken from the knee-joint at the time of the aspiration showed numerous leucocytes, diplococci, and some short chains of three or four elements. About many of the organisms a distinct capsule could be distinguished. Cultures made from this material on glycerin agar and blood serum showed typical growths of pneumococci in pure culture. The organism also grew on gelatin and in bouillon. It stained by Gram's method. Inoculation of animals was not made.

The following report is from the Pathological Laboratory of Lakeside Hospital, under the direction of William T. Howard, M.D.:

Autopsy five hours after death, by R. G. Perkins, M.D., Resident Pathologist of Lakeside Hospital. Circular amputation, wound of lower third of left thigh, containing pus and showing pneumococcus and staphylococcus pyogenes aureus in cultures. Acute splenic tumor with hæmorrhagic infarction. Œdema and congestion of lungs, fatty degeneration and cloudy swelling of heart, liver, and kidneys, myomata of uterus, slight chronic apical tuberculosis of right lung.

The amputation stump of left thigh at junction of upper and middle third was closed by several sutures in the central portion, the sides being left open and packed with gauze. On opening the wound a considerable amount of pus escaped. Several sinuses extended from the wound for some distance up the thigh. The muscles were a dark red color and softened. Gangrene was not present. The skin was normal. No thrombi were found in the vessels of the thigh.

Histological description by Dr. Howard. Sections of tissue taken from various parts of the amputation stump showed

marked atrophy of the muscle tissue, with considerable increase of the intermuscular connective tissue. Sections including the free border of the wound were covered with a thick layer of both amorphous and fibrillated fibrin, containing a considerable number of polymorphonuclear neutrophilic leucocytes and plasma cells. Beneath the fibrin layer there was a recent granulation tissue fairly rich in blood-vessels, but showing a remarkable paucity of leucocytes. In some places there was a marked infiltration with plasma cells and small round cells about the blood-vessels. No giant cells were found. In other places the muscle nuclei showed active proliferation, and in still other areas there was marked atrophy of the muscle tissue. Histological diagnosis, interstitial myocitis with suppuration.

Bacteriological Examination.—Coverslip preparations from the amputation stump wound show large numbers of encapsulated lanceolate diplococci. Glycerin agar, petri plate cultures made at the autopsy from heart's blood, lungs, liver, spleen, and kidneys remained sterile after three days in incubator. Similar plates made from the amputation wound gave large numbers of pneumococci together with some colonies of staphylococcus pyogenes aureus. As the other organs showed nothing of present interest, their description is omitted. It is of interest, however, to note that cultures from the lungs were negative, and microscopic examination of sections from these organs showed no pneumonia. In the light of the autopsy findings it seems clear that the pneumococci in the amputation wound were present before operation, having spread through the tissues from the infected joint. The staphylococci probably reached the wound secondarily from the skin.

An analysis of the three cases previously collected by Cave is as follows:

CASE I.—Reported by Griffon in *Bulletin de la Société Anatomique*, April, 1896. The patient, a woman aged seventy-one years, on admission was comatose and had a temperature of 104° F. She had a suppurative arthritis of the right ankle-joint. The joint was immediately incised and drained, death following the next day. Extensive suppuration in the ankle and the calcaneo-astragaloid joints and also the neighboring synovial membranes was found. The autopsy showed meningitis of the vertex and

recent vegetative endocarditis. The pneumococcus was demonstrated in material from joint, cardiac vegetation, and purulent exudate in meninges.

CASE II.—Widal and Meslay. *Bulletin de la Société Médicale des Hôpitaux*, January 24, 1896. The patient, male adult, had a history of lead poisoning, and complained of dysphagia and arthritis, the latter involving the first metatarsophalangeal joint of left foot. The joint was swollen, hot, red, and painful. The patient's temperature was 101° to 102.2° F. At the end of a fortnight the temperature fell, the pain abated, the patient, however, being mildly delirious and extremely feeble. Localized pericardial friction rubs were discovered. Ten days later patient collapsed and died. Autopsy showed large, purulent pericardial effusion and a seropurulent collection in the affected metatarsophalangeal joint. Pus from both effusions showed pneumococcus in pure culture.

CASE III.—Widal and Lesne. *Ibid.*, May 6, 1898. Male, aged sixty-eight years; history negative, except for slight chronic rheumatic pains in smaller joints. The patient was seized suddenly with a violent chill, headache, fever, and general aching. The next day the pain was present in whole of left upper extremity. On the third day the pain was localized in the left sternoclavicular joint and back of the hand, and the parts were red and swollen. Admitted on the eighth day with temperature of 102.2° F., inflammatory swelling in parts indicated above. The sternoclavicular joint suppurated, and pus withdrawn showed a pneumococcus in pure culture. The swelling on the hand gradually subsided, but was slightly œdematous when discharged six weeks later.

In comparing our case with those just cited, there will be noticed this difference in the post-mortem examinations. Whereas, in the two cases of primary infection cultures of pneumococci were obtained from other organs than the part first infected, in the case which is here reported no evidence of infection was found at the post-mortem after the most careful examination of other organs. Of the twenty-eight cases which are cited by Cave, in which there was infection of joints associated with pneumonia, twenty-one cases died. This is

enough to show the great virulency of the infection, although it might be a fair question as to the part borne in the final result by the local process as compared with that in the lung. In the cases in which the infection was strictly local, it is apparent that this also was extremely virulent. Of the three cases collected by Cave, two died, and, as has been said, cultures showed that there had been secondary infection of other organs. In the case just reported, notwithstanding the fact that no secondary infection could be found, the toxæmia seems to have been especially virulent. The absence of the pneumococcus in the blood or in organs would seem to show that the patient died from toxæmia secondary to the local infection.

Four cases are, of course, too few to permit of any generalization; and still it seems evident that local infection with pneumococcus unassociated with pneumonia is especially virulent, being fatal in 75 per cent. of the reported cases. How the infection could have gained access to the joint is, of course, difficult to explain, but the explanation doubtless is similar to that in cases of osteomyelitis, viz., that it is carried by the blood-current to a point of diminished resistance. The point of origin of the infection cannot be determined, but there is abundant opportunity for the absorption of the pneumococcus from exposed surfaces. Although so few cases of this special infection have been reported, it is by no means certain that they are not more frequent than is supposed; and it is presumable that the careful study of joint infections may disclose the fact that the pneumococcus is a much more common cause of infection than would seem to be shown by the observations which have been made up to the present time.

SOME OBSERVATIONS ON FRACTURES OF THE
SKULL, BASED ON ONE HUNDRED AND
FORTY-SIX CASES.¹

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It is not my object in this paper to go into all the numerous theories which have existed from time immemorial in regard to fractures of the skull. These theories, and the controversies they have engendered, have arisen largely from the way in which different observers have looked at the same injury, and have unduly emphasized one or another feature which to their minds has been the salient element in injury.

The skull, it shall be remembered, is a bony spheroidal case, of curious architectural construction, which varies in some detail in every case and at different times of life. Furthermore, no two injuries are produced in exactly the same manner. Even the varying muscular rigidity of the individual will influence the character of the injury. This is, of course, influenced, too, by the cause which has produced it. For example, the head may have been caught between heavy falling beams and crushed; or we may have a small punctured or stellate fracture, such as is caused by the point of a pick entering the skull, causing no injury except at the point of entrance, and not even wounding the membranes. A fissured fracture may be the result of the blow from a sand-bag, producing a simple fissure of very short extent, which closes so accurately that it can only be discovered with the greatest difficulty. Again, a fissure may radiate from the point of impact to the

¹ Read before the Philadelphia Academy of Surgery, March 4, 1901.

base of the skull, or, as has been frequently noticed, appear only on the opposite side of the skull from the point where the blow has been received, producing the variety known as *contre-coup*. (This variety of injury is easily demonstrated by physical experiments on definitely shaped bodies.) Still other varieties are explained by what is known as the bursting theory, in which the opposite sides of the skull are brought nearer to each other, with the result that the intermediate portion gives way.

It is impossible to say what the result will be after a definite blow has been delivered upon the vault of the skull. A fracture at the base, or a fracture at the point of impact, or simply a jarring of the cerebral mass, may occur, depending upon the strength and resistance of the bony parts involved. It will be obvious that it will be hardly necessary here to go into a minute description of the different varieties of fracture of the skull. They may be conveniently divided into simple, compound, comminuted, fissured, or depressed, according to the position and the part of the skull involved, and all of them may exist with or without noticeable injury to the skull contents. Other general divisions frequently made by hospital surgeons, and made with regard to location, are fracture of the vault and fracture of the base. Not unfrequently we find the former running or extending into the latter, and both vault and base involved. (The writer is inclined to lay much stress upon these two varieties.) A fracture of the skull may be a most trifling injury, whereas injury of the base should always be considered one of the gravest of head injuries.

Fractures of the base of the skull are not produced by the same character of force that we find causing similar injuries to the vault, for the weight of the body is in this case more often a factor, driving the vertebra up against the skull and resulting in a fracture of the posterior and middle fossæ, for the reason that a concentrated force will, in all probability, produce a fracture at the point of impact, whereas diffused force is likely to cause a fracture of the base,—a result to be accounted for by the vibratory theory of *contre-coup*. Aran's

"radiation" theory is that fractures of the base occur because of the radiation of fissures from the point of application of the force. He conceived that the fissures passed by the nearest route to the base and involved it in the fracture. He furthermore discovered, as the result of experiments, that the part of the vault which was first struck would give the key to the fracture which would take place at the base. Thus, injuries produced in the front part of the vault indicate fractures of the anterior fossa, those of the middle part of the vault to fractures of the middle fossa, and those of the back of the head to fractures of the posterior fossa. In 1880, Meserer expressed the opinion that fractures of the base always occur in the direction of the force applied, or, at any rate, parallel to it, and considered these not as the result of radiation, but of bursting forces. His theory may be illustrated by subjecting a hollow sphere to pressure. The breakage will occur either at the point of immediate pressure or by bursting at the most distended part. This theory was accepted by the late Professor Ashhurst, and, from a physical stand-point, must undoubtedly carry much weight.

To sum up practically the results of diffused blows upon the skull, we find that their chief effect is at a distance from the point of their application. Blows struck on the vault produce fissured fracture in the corresponding segment of the base. Those struck on the periphery of the base produce fissured fractures on the base of the skull parallel to the direction of the force applied. It is only by the careful consideration of the initial force that an intelligent idea of the character and direction of the fracture can be obtained.

The term fracture is used generally to express any break in the continuity of the skull, and may mean the simplest fissure of the vault without any cerebral symptoms, or be employed to express a complete crushing of the skull and its contents. It is, however, usual to distinguish such fractures into fractures of the vault and fractures of the base. A fracture that is confined to the vertex is not necessarily a more serious injury than a corresponding fracture of any of the flat bones elsewhere.

The danger depends on injury to the underlying structures, such as wounds to the vessels, sinuses, or brain substances. The prognosis should depend upon the accuracy of the diagnosis, which in its turn must depend largely on the ability to explore or determine the exact amount of destruction to the bone and to the underlying parts, which latter is by far the more serious factor in the injury. We know that in simple fissuring the bony margins, after often having injured the parts beneath, immediately return to their natural positions. Consequently inspection of a superficial wound is no index of the harm that may have occurred in the tissues below. Another variety of injury is caused by the splintering of fragments from the area of the fracture, causing wounds of the brain or membranes. A large fragment may have been separated and driven deep into the brain substance. Any of these conditions are liable to produce pressure either from a fragment of bone pressing on the brain, or from effused blood escaping either from the diploe or from a wounded meningeal vessel. It seems, to-day, to be the consensus of opinion that the latter is much the more serious condition of the two,—a condition which, if not soon relieved, is bound to be followed by fatal results.

Diagnosis of fracture of the vault is very simple if the wound leads down to the seat of injury, or if by slight enlargement the fracture may be brought into view. The cases which require the greatest amount of skill are injuries in which there is no external wound, for then much uncertainty often arises in determining whether depression in the soft parts really corresponds to a distinct depression in the bone. Frequently the only way in which such an uncertainty can be made a certainty is by making an incision; and when made for this purpose, such an incision is perfectly justifiable, provided proper aseptic precautions are observed. Sometimes the suspected margin of bone can be felt with a needle by puncturing the skin and exploring the surface of the bone. When the patient is conscious, he may be able to give information as to the character of pain when pressure is made over the injured part, especially

if a fragment is loose. Still, there is no doubt that, with all aids to diagnosis, many cases of fracture of the skull go unrecognized, and are not detected until a post-mortem is made. The writer feels that many children recover from unrecognized fracture. So long as a fracture is simple and uncomplicated, its determination is not a clinical necessity, but rather of scientific interest.

It is worth while to mention two errors that are often made in the diagnosis of fractures of the vertex,—one, the mistaking of normal fissures for fracture, especially unobliterated frontal fissure, over which a trephine has been applied on more than one occasion; and, second, simple incised wounds of the skull are frequently mistaken for fissured fractures. In cases of doubt in either of these conditions a small piece of the skull removed with a gouge at right angles to the fissure will determine the exact character of the injury.

On theoretical grounds, fracture of the inner or *vitreous* table should be much more common than we are led to believe it is, owing to the direction of the force and the character of the bone involved. It has been stated that it is impossible to sustain a fracture of the inner table without a corresponding injury of the external. This statement will hold good for delicate skulls with little or almost no diploic structure; but in skulls with thick diploic layer and thin outer table, a fracture of the latter may easily occur without injury to the inner table.

I will now pass to the consideration of fracture of the base of the skull, and speak of the treatment of the two varieties together. I have already referred to some of the causes of, and the theories that are entertained in regard to, fracture of the base of the skull. Any of the fossæ may be involved, or the fracture may extend from one into the other. Fractures involving the middle and posterior fossæ are frequently seen.

Fractures of the posterior fossa occur, for the most part, by violence applied posteriorly and from below. There is often a ring form of fracture produced by the impact of the spinal

column on the base of the skull, as when an individual falls on his head, producing a fissuring of the base away from the jugular fossa, or towards the foramen spinosum,—the most common site of fracture of the petrous portion of the temporal bone. Probably the most frequent site of fracture of the petrous bone is through its weakest part, which corresponds to the position of the middle ear; and a fracture here is often accompanied by bleeding from the ear, or with escape of cerebrospinal fluid.

Fracture of the anterior fossa may involve the central portion of the orbital plates, or may extend to the optic foramen, or to the sphenoidal fissure, or may pass transversely and involve the cribriform plate. The study of the mechanism of basal fracture is of the greatest importance, as we may thus explain how forces are distributed to certain portions of the base of the skull, and show how frequently effect follows the cause, and that blows on the side of the skull usually result in fissures of the base of the middle fossa.

During the preparation of this paper, the case of a child who had fallen from a window, striking the side of its head, causing a large hæmatoma with hæmorrhage from the external ear, came under the writer's care. The diagnosis of fracture at the point of impact, with fissuring involving the middle fossa, was made. This was verified by incising the scalp and raising a large displaced fragment, and a long fissure extending towards the middle fossa, which in all probability involved a part of the petrous bone.

A large percentage of fractures of the base of the skull are mere fissures, which are often very firm, and which close almost instantly after their production, so quickly, in fact, that blood is not found between them. Sometimes rare forms of fracture will be found, as breaking of either of the clinoid processes of the sphenoid.

Prognosis of fracture of the base of the skull depends largely upon the violence which has caused it; and the majority of fatal cases are due to contusion of the brain or the large nerve trunks, or hæmorrhage from other intracranial lesions

resulting from the same violence. The longer the fissure the greater the danger, especially when it takes its origin in the vertex, thus being more likely to invade some of the air cavities and produce a compound fracture. Fissures which are definitely confined to the base are not exempt from the danger of air infection from any of the air sinuses, as the ear, frontal, sphenoid, and ethmoid, making the fracture compound in character, although no external wound is evident. Another important factor which must be carefully considered is the amount of injury to the brain substance. Any positive evidence of such injury having taken place should always be regarded as most unfavorable; although the writer recalls a case in which a drachm of brain substance escaped from the internal ear in a bad basilar fracture, and yet the patient recovered, though with impaired brain function. This shows that recovery often follows undoubted fracture of the base of the skull, sometimes of the severest character. There is no doubt that a large percentage of the cases of basilar fracture that recover do so with some impairment of sight or hearing, or some special sense disturbance due to pressure or exudate along the nerve trunks. The impairment of brain function, whether temporary or permanent, depends upon the amount of concussion received by the brain at the time of the injury.

The diagnosis of fracture of the base of the skull depends largely upon the careful consideration of three distinct phenomena:

(1) The escape of blood from the seat of fracture until it is detected at certain points beneath the skin.

(2) The escape of brain substance, blood, and serous fluid from the skull, through the nose, pharynx, or external ear.

(3) The impairment of the nerves of special senses, or functional disturbance of any of the cranial nerves. The spread of blood may be beneath the skin, or mucous membrane of the pharynx, or conjunctiva, all of which are points where ecchymosis is likely to appear when an injury has oc-

curred; though these conditions are by no means infallible signs that fracture of the skull exists.

Ecchymosis about the eye is a most common condition following trifling injuries in the region of the eye, and appears almost immediately after the reception of the injury. Those ecchymoses which appear two or three days after the injury are much more significant. Fractures which extend into the orbit give rise to hæmorrhage into that cavity and cause protrusion of the eye. I do not recall a case where this was the only symptom present: but when it does exist, it is significant of serious trouble, and probably indicates the rupture of a large vessel. Escape of brain substance means, of course, a break somewhere in the base of the skull. When coming from the external ear, it means some break in the wall of the upper part of the ear apparatus. It has been stated that this condition is much more liable to happen in persons advanced in years, owing to the rarefaction of the bones about the tympanum. The writer recalls a case, however, where a considerable amount of brain substance escaped from the ear of a child who had sustained a fracture of the base of the skull.

The escape of blood from the ear, nose, and pharynx are common occurrences in basal fractures. The ear is the most frequent point of exit, owing to the tunnelling of the petrous bone by canals which connect with the ear in such a way that blood is liable to escape in considerable quantities if the petrosal sinuses, or any large meningeal vessel, have been injured. Blood may, however, find its way through the external ear as the result of a slight contusion rupturing the tympanum. The origin of the hæmorrhage can often be determined by the careful use of the otoscope.

The escape of serous fluid, either mixed with blood or by itself, is a pathognomonic sign, and where it escapes there must be some tear in the dura or arachnoid, as well as a fissure in the same portion of the petrous bone. Where the two fluids—that is, blood and serum—are mixed, the latter, in doubtful cases, can be detected by rubbing the effused material between the thumb and finger, when the peculiar quality of

serum will manifest itself; whereas blood alone would soon become dry and sticky. The amount of fluid that may escape varies. If the hæmorrhage only comes from the vessels in the ruptured tympanum, it will be of short duration, as the vessels are very small and will soon cease to bleed. If, however, it arises from a torn sinus or vessels of the dura, it may be very persistent, lasting for several days. As a rule, the escape of serous fluid is not so profuse as the escape of blood, but often lasts for a much longer period, sometimes as much as from one to two ounces escaping in twenty-four hours. A case is cited where sixty-three ounces escaped in 106 hours. Some abnormal condition of the brain may have existed in this instance, however. At other times, hardly enough will escape to be recognized.

Hewitt states that nearly 50 per cent. of fractures involving the middle fossa were accompanied by distinct bleeding from the ear. In 70 per cent. of the cases which did not bleed, the tip of the petrous bone was involved, as shown by post-mortem examination. My own experience would lead me to believe that bleeding is a much more frequent occurrence, but I regret that I have no exact data on this important symptom.

The paralysis of certain cranial nerves, or groups of nerves, as before mentioned, is significant of basilar injury, as these nerves are frequently impinged in their exit where involved by the fracture; or they may be injured by a spicule of bone dividing, pressing, or bruising them, and thus result in loss of function to the parts supplied by them. Similar conditions may result from injury to the origin of the nerves in the brain. The seventh and eighth pairs of nerves are those most frequently involved; although in one of the writer's recent cases there was paralysis of the fifth, sixth, seventh, and eighth pairs of nerves; yet practical recovery ultimately resulted.

Emphysema of the tissues about the orbit and nasal passages is significant of some break in the continuity of the air passage, and may possibly exist in the region of the mastoid.

It is, however, so common in other injuries, as in fracture of the nose, that its presence must be carefully considered with other symptoms before a positive diagnosis is made.

Coma is in nowise diagnostic of fracture of the skull. It may be present in a number of traumatic conditions involving the brain in which the skull is intact. It is present, however, to a greater or less extent, in all severe fractures, especially those of the base of the skull. This condition is frequently confused with coma produced by alcohol. The value of its proper recognition cannot be overestimated, not only because it is the condition with which traumatic coma is most liable to be confounded, but because error in diagnosis may inflict so much unnecessary suffering and possible disgrace to the patient, and involve additional danger. Such an error places the most serious responsibility upon the surgeon. Many head injuries have been mistaken for alcoholism and the patient left to die in a police station. Coma should not be ascribed to alcohol except after the strictest process of exclusion, after every symptom of head injury has been considered seriatim. In discriminating between the two forms of coma,—alcoholic and traumatic,—the temperature is our best guide. In the former the temperature is subnormal, whereas in the latter it is slightly above normal, except shortly after the receipt of the injury, when considerable shock may be present. As reaction begins, however, it soon rises until it reaches a point several degrees above normal.

The prognosis in fractures of the base of the skull depends mainly upon the extent of the violence which has produced the injury. The danger arises from contusion of the brain or large nerve trunks, or other intracranial lesions, which may have resulted from the same violence. The longer the fissure the greater the danger, especially when the fissure radiates from the vertex, as there is then more danger of some of the air cavities of the skull having been opened, and thus the fracture rendered compound,—a contingency which should always be carefully considered because of the ease with which such an opening of the air-cells may have occurred, and the difficulty

of detection. The fatal element in such cases, as before stated, is injury to the skull contents. Rarely is an average fracture of the base of the skull beyond repair; almost everything depends upon how much the brain has been injured, and whether septic infection can be prevented. The recovery from basilar fracture is seldom ideal; some lesion, or impairment of the special senses, or cranial nerves, is apt to remain to a greater or less extent.

Little dependence can, however, be placed on statistics of fracture of the base of the skull. Out of forty-six cases of this variety of fracture which occurred in my own practice, 69.5 per cent. terminated fatally, and 30.5 per cent. recovered so that they were able to leave the hospital in fair condition. Possibly, in some of the cases cited as having recovered, fracture may not have existed, as post-mortem verification was impossible, but all doubtful cases were carefully excluded. I find that these percentages are almost identical in both hospitals from which I have collected my data.

The *treatment* of fractures of the base of the skull is largely expectant, the part involved being practically beyond the field of surgical intervention. There is little left for the surgeon to do except to assist the tendency of nature to repair the injured parts. The salient features of the treatment might be mentioned, in brief, as: absolute rest in bed with ice-bags or cold compresses to the head; thorough sterilization of the auditory canal if blood or serous fluid is escaping, and protection of it with some aseptic dressing; the administration of small quantities of calomel and opium by the mouth, preferably in the form of Dover's powders, two grains of pulv. Doveri and one-quarter grain of calomel every three hours, and an ice-bag to the head. Such is the routine treatment usually pursued. On theoretical grounds opium should be contraindicated in head affections; but practical experience has led me to believe that it is one of the most useful remedies that we have at our command. Figuratively speaking, it puts the brain in splints, and thus places it in the most favorable condition for the repair of its injuries. Of course, it must be used with

discretion, especially if there arise any signs of coma. Calomel is an old remedy in these conditions, and is valuable for, as the old writers say, its "anticipatory antiplastic effect." All those careful hygienic attentions should be paid which the thoughtful attendant's good sense will naturally suggest, but which are beyond the scope of this paper.

In the treatment of fractures of the vault of the skull, especially from an operative point of view, the surgeon should resort to every means in his power to restore the continuity of the skull, even if no signs of compression appear. The treatment of a simple fracture of the vertex, so long as no operation to relieve depression is called for, should be of the simplest possible character, corresponding to the general principles laid down for governing injuries of the base of the skull. When depression does exist, even though the external parts are not injured, the treatment, contrary to the teachings of many distinguished surgeons, should at once become operative. The consensus of opinion of the more advanced surgeons of to-day is, that it is not only justifiable, but the best practice, to cut down and elevate the depressed fragment of bone. This opinion seems correct for many reasons, aside from those immediately apparent, when we consider the secondary and remote consequences of the lesions, if dealt with in the manner advised by the less advanced surgical teachers. If properly performed, the operation is not nearly so dangerous as failure to relieve the presence of so plain an indication. I may go even farther, and say that I think it advisable in doubtful cases to incise the scalp over the questionable point and be positive whether a depression exists or not. By following this procedure, fractures have been recognized which would otherwise have been overlooked.

In dealing with compound injuries, the course to pursue is, in the majority of cases, much plainer. The fact of the existence of an open wound makes the diagnosis easier. Here it is imperative, aside from the relief of points of pressure, to remove all loose splinters and spicules of bone which are liable to wound or irritate the dura or cortex; and, in fact, to get

rid of all tissue, soft or bony, whose vascular supply is such as to make its nutrition doubtful. The wound in many cases may be closed with the view of procuring immediate union; but if there is a disposition to bleed, either from the dura or diploë, it is much wiser to pack the wound with gauze and depend upon closing it later. If the wound be infected at the time of operation, a drainage tube may be inserted; but it is rarely necessary to carry this tube beneath the edge of the bones, carrying it out of the most dependent part of the scalp being all that is necessary. Early and frequent dressing of the wound is imperative, especially in septic cases, as the slightest retention of pus or other product of inflammation is liable to set up meningitis, which is frequently and rapidly fatal.

A few words with regard to stellate or punctured fractures. These are invariably depressed, with ragged, irregular edges, and unquestionably call for the use of the trephine or the rongeur forceps, until the edges are smooth, and all sources of irritation to the dura or cortex are removed.

The operation of trephining *per se* in careful hands is practically without risk, and where cases of fracture of the skull terminate fatally, it was not the operation, but the condition which demanded it, that caused death. In the writer's tables this operation was performed in twenty-six cases, all but three of which recovered, making a mortality of about 11.5 per cent., compared with a mortality of over 51 per cent. in the pre-aseptic era.

The appended table is the result of the deductions made from cases which occurred in the writer's service at the Episcopal and Pennsylvania Hospitals during a period of ten years in the former and seven years in the latter.

Total number of cases treated.....	146		
Number of recoveries.....	84	57.5	per cent.
Number of functions impaired.....	11	15.06	" "
Number of deaths.....	62	42.5	" "
Number of deaths within twenty-four hours	54	87.1	" "
Number of trephine operations.....	26		
Number of trephine operations recovered	23	88.5	" "

Number of trephine operations died.	3	11.5 per cent.
Average number of days in hospital, those recovered (not within twenty-four hours) . .	18.8	
Average number of days in hospital, those died (not within twenty-four hours)	3.64	
Average number of days in hospital, those trephined; recovered	22.28	
Average number of days in hospital, those trephined; died	3.66	

SUPPURATIVE PERICARDITIS FOLLOWING AP-
PENDICITIS; RECOVERY AFTER INCISION
AND DRAINAGE OF PERICARDIUM.

By ARTHUR HOWARD MANN, JR., M.D.,

OF BALTIMORE.

L. S., white, female, aged twelve years, was seen with Dr. John R. Abercrombie, March 3, 1900, presenting the following history and symptoms: Family and previous history are negative so far as having any bearing on the present illness. Four days previous to the above date (February 28), the child was seized with general abdominal pains, nausea with vomiting, fever, and accelerated pulse. Dr. Abercrombie saw the child twenty-four hours after the onset of the symptoms.

March 1, A.M., he found the temperature $103\frac{3}{5}^{\circ}$ F.; pulse, 120, and respirations, 30. There was severe abdominal pain, not localized in any particular place, nausea, and vomiting. Constipation had existed for several days. The abdomen was moderately distended, with increased resistance at a level with the umbilicus under the right rectus muscle, this particular point being somewhat tender and painful on deep pressure.

A diagnosis of probable appendicitis was made, and the patient was kept quiet. Small doses of calomel were ordered and a liquid diet. During the day the local conditions remained about the same, with a slight drop in the temperature towards evening to $102\frac{1}{5}^{\circ}$ F.; pulse, 120; respirations, 28.

March 2, A.M., temperature, 102° F.; pulse, 120; respirations, 25. Patient not so well as yesterday; pain in abdomen was more severe, with decided distention, nausea, and vomiting, bowels constipated; resistance under the right rectus muscle more marked than yesterday, but no tumor was felt. The child was given a high rectal enema, containing one ounce of Rochelle salts and sweet oil; teaspoonful doses of salts were frequently given during the day by the mouth.

P.M., temperature, 103° F.; pulse, 122; respirations, 28; condition about the same.

March 3, A.M. I saw the little patient with Dr. Abercrombie, and found her in about the condition as described above,—temperature, 103° F.; pulse, 120; respirations, 26. The child had been vomiting during the night quite frequently; the bowels not being moved. The abdomen was found to be much distended; the movements of the intestines could be felt and heard through the abdominal wall. There was marked resistance on the right side under the rectus muscle at about the level of the umbilicus, and extended several inches downward. An ill-defined mass could be made out in the right iliac fossa, pressure upon which caused pain; in addition, she complained of pain in the right wrist and in the knee and ankle on the left side, which were found to be red, swollen, and painful, fluctuating, containing fluid; the synovitis resembled an acute articular rheumatism. The diagnosis of appendicitis was agreed to, and an operation was thought would be required.

The patient was sent to the Church Home and Infirmary, so as to be convenient if an operation should be found necessary. Soon after entering the hospital she had a number of large loose stools during the afternoon, followed by marked improvement in all the symptoms except as to the joints, the temperature and pulse falling nearly to normal, the nausea and pain disappearing.

March 4. No pain or distention of the abdomen, resistance normal, and nothing to be felt in the iliac fossa. The joints, however, are much swollen and very painful, and a slight rise in temperature and pulse, presenting the appearance of an acute articular rheumatism. The joint symptoms continued for several weeks, notwithstanding large doses of salicylic acid.

March 7. Dr. Abercrombie, while auscultating the chest, discovered a mitral murmur, it not being present before, as the chest had been examined each day. The joint symptoms about the same, with only a moderate febrile reaction.

March 10. During the afternoon the patient was found to have difficulty in breathing and was much collapsed. Dr. Abercrombie was sent for, and found the patient in the following condition: Temperature, 104° F.; pulse, 140; respirations, 40, the symptoms looking like a severe septic intoxication. Upon examining the chest, the cardiac dulness was found to be much in-

creased, extending several inches to the right of the sternal line and as low as the eighth rib, the heart sounds indistinct, with a mitral murmur.

March 11. The patient presented quite the same condition,—temperature, 104° F.; pulse, 146; respirations, 42. During the night the child had several spells of great difficulty in breathing, with collapse, the pulse being extremely weak and irregular.

On examining the chest we found the cardiac dulness much increased, extending about three and one-half inches to the right of the sternum, and on the left to the axillary line on the level of the sixth rib, and a dull place in the back, Ewart's (*British Medical Journal*, January 23, 1897) "pericardial dull spot," extending to the middle line along the lower border of the scapula and to the left for a distance of about four inches, reaching as high up as the spine of the scapula. The heart sounds were transmitted to the ear very indistinctly through the back. The murmur also could be heard. The heart sounds were also very indistinct through the anterior chest wall, and sounded far off. The heart dulness was marked out on the anterior chest wall with an aniline pencil, so that any increase of the effusion might be watched.

March 11. Condition unchanged.

March 12. Temperature during the evening reached $104 \frac{1}{5}^{\circ}$ F.; pulse, 150; respirations, 46. General condition more septic. The area of dulness was found to be slightly larger. A diagnosis of suppurative pericarditis was made, and operation done early in the morning.

March 13. Drs. Abercrombie and Gavin assisted at the operation. Ether was the anæsthetic. The field of operation was rendered aseptic in the usual way. A large aspirating needle was pushed through the fifth intercostal space to ascertain the character of the fluid, and at once came in contact with the heart; the violent cardiac pulsations against the needle could be plainly felt. No fluid could be aspirated except a few drops of blood. The needle was then withdrawn and introduced through the fourth intercostal space about two inches to the left of the border of the sternum. The resistance disappearing, the needle was found to be in a cavity, with the heart pulsating against it. On making the vacuum in the aspirator, about two drachms of a bloody purulent fluid were drawn out. The needle was then disconnected from the aspirator, but allowed to remain in the pericardium to

serve as a guide. An incision four and a half inches long was made parallel with the border of the sternum and two inches to the left down to the ribs. Two inches of the fourth rib were resected, the internal mammary artery was ligated, and the pericardium then opened, whereupon a quantity of a purulent bloody fluid ran out. The pleura was not seen, being pushed out of the way to the left. The heart was suspended in the large pericardial sac in close relation to the anterior chest wall, the pericardium being much distended. The fluid was nearly all posterior to the heart, as in a case related by Money (*British Medical Journal*, December 1, 1888, p. 1220), where at an autopsy twenty-four fluidounces of pus were found in the pericardium, "almost entirely stowed away behind the heart." The patient was then rolled over on the left side, and about 800 cubic centimetres of pus ran out. On placing the patient on her back, the pericardium did not collapse very much, not coming in contact with the heart, the heart being suspended by its great vessels and pulsating in space, so to speak. The pericardium was then freely opened and stitched to the edges of the wound, and a long strip of sterilized gauze was put in the pericardial sac below and behind the heart; a large sterile dressing was then applied, and the patient returned to bed in good condition. The temperature and pulse did not drop very much, reaching $103\frac{2}{5}^{\circ}$ F. and 140 respectively during the evening. The next day she was comfortable; no distress in breathing; but the temperature and pulse continued high.

March 15, A.M. The dressing was removed, the gauze was taken out of the pericardium, whereupon a quantity of pus escaped, the gauze stopping rather than assisting the drainage. Two medium-sized rubber tubes were then put into the pericardial sac; there was, however, much difficulty in keeping them in place, owing to the pulsation of the heart. The trouble was easily overcome by fastening them to the skin with a small safety-pin. There was much discharge through the tubes during the day, sufficient to wet a large dressing. The temperature and pulse dropped to $99\frac{1}{5}^{\circ}$ F. and 120 respectively during the afternoon, never reaching 100° F. after. The little patient commenced to improve from then; in the course of three weeks the wound was healed, and she was able to be out of bed. The tubes remained in ten days. She has gained very much in weight during the year, but still has a mitral murmur; otherwise she is in good health.

Some of the fluid was caught in sterile test-tubes for examination. Fresh preparations under the microscope showed many red blood-corpuscles mixed with the pus-cells, and large numbers of diplococci were seen in the fresh stained specimens. Cultures were made in the usual way and pure cultures of the pneumococcus were obtained, no other organisms being present.

The case is of interest for several reasons: first, on account of the severe abdominal symptoms which were present at the beginning, which were definite enough to lead to a highly probable diagnosis of acute appendicitis; the rapid subsidence of the abdominal symptoms as soon as the bowels were freely moved; the marked synovitis of the joints, which presented the appearance of articular rheumatism, or rather a part of a general septic infection, and the abrupt onset of the pericardial trouble.

I am much inclined to think that the patient, in the first instance, was suffering with appendicitis, which was most likely due to an infection of the pneumococcus; and this might have been the cause of a general infection, with localization in the several joints causing an acute synovitis, with effusion and infection of the pericardium and endocardium, the former going on to suppuration. There is nothing definite about this theory, however, as the exact condition of the appendix was not ascertained by operation. The symptoms, however, which the child presented in the first were typical of appendicitis. Another reason why one might suppose the infection of the appendix was due to the pneumococcus is the fact that the patient recovered without suppuration (?) in the appendix, as the infection of the pneumococcus does not always go on to the formation of pus. This is only a supposition, as the appendix might have recovered without suppuration, no matter what the nature of the infection, or burst into the intestine if it did suppurate.

Another point of interest in the case was the large size of the area of pericardial dulness in the back, and the extremely feeble heart sounds in front, notwithstanding the fact that

the heart was in direct contact with the anterior chest wall, and the marked displacement of the heart to the right.

One might have easily been misled on introducing the aspirating needle into the pericardium at the usual point, *i.e.*, in the fifth intercostal space close to the sternum, and, getting no fluid, might have supposed that the pus was not in the pericardium.

It was quite evident, after opening the chest, that no matter at what point the aspirating needle was introduced in front, the pus could not all have been withdrawn, owing to the extreme depth of the pericardial sac and the position of the heart.

The pericardium was much changed in appearance, being thicker than normal, also very brittle. It was lined with flakes of fibrin, and hæmorrhagic spots were seen on its surface. The visceral pericardium was covered quite extensively with a fibrinous exudate.

The pleura, which should be carefully avoided in these cases of operations on the pericardium, was not seen, as the great distention of the pericardial sac had so displaced the pleura as to push it quite to the axillary line. The statement of Fowler (*Transactions of the American Surgical Association*, 1896, Vol. xiv, p. 161), that the pleura boundaries are greatly displaced in pericardial distentions, was no doubt true in my case. Roberts (*American Journal of the Medical Sciences*, December, 1897, p. 625), however, does not think that such displacements occur, on account of the pleura attachment to the chest wall.

The recovery of the patient may have been somewhat influenced owing to the infection being the pneumococcus, as in empyema cases we know that recovery is more likely to follow an infection of this kind than from an infection of the ordinary pyogenic organisms, especially infections when due to the streptococcus pyogenes.

We also know that patients, especially children, often recover from extensive empyema after simple aspirations, when the infection is due to the pneumococcus alone. Such results,

however, are rare, and not to be looked for, if the infection is due to the pus organisms (pyogenic) or to a mixed infection. In such cases, opening the chest, resection of ribs, and drainage are called for. Therefore suppurative pericarditis due to the pneumococcus may run a more favorable course under proper treatment,—which should always be opening and drainage of the pericardial sac,—than if due to the pyogenic organisms or a mixed infection.

If such is the case, which can only be determined by careful investigations, then it is important that the variety of the infection should be determined at the earliest possible time after operation which would influence the prognosis in such cases.

The condition of the joints in this case resembled closely part of a general septic infection rather than a rheumatic inflammation, for, notwithstanding large and frequent doses of salicylic acid, the effusion and pain continued for several weeks.

In concluding this report, I can do no better than refer the reader to the article by Roberts (*American Journal of the Medical Sciences*, December, 1897, No. 6) which deals most fully with the treatment of suppurative pericarditis.

A REPORT OF TWO CASES OF FACIAL ANTHRAX
TREATED BY INJECTIONS OF CARBOLIC
ACID, WITH RECOVERY.

By LOUIS H. MUTSCHLER,

OF PHILADELPHIA.

At a meeting of the Philadelphia Pathological Society in December, 1899, Dr. Jopson reported a case of anthrax that came under his care at the Episcopal Hospital dispensary. In his paper he mentioned three other cases besides his own, making four in all that had been reported in Philadelphia. Of these four cases, three terminated fatally, and the outcome of the fourth was unknown. During the past few months I have had two cases of anthrax under my care, and on investigation I have learned of three other unreported cases that have occurred in Philadelphia. Briefly, they are as follows:

The first case was seen, five years ago, by Dr. Harry Deaver. The man was employed in a tannery; the point of infection was on his neck; he had slight fever; his head, neck, and chest were œdematous; he died in a few days. Pure cultures of anthrax bacilli were obtained from this case.

Dr. Loeb supplied me with notes of the second case. The patient came to the dispensary of the Jewish Hospital about one year ago. His occupation was that of a tanner. The point of infection was on his neck, and when he applied for admission his neck and chest were œdematous; he had a slight fever, otherwise he felt well. Microscopical examination of the discharge from ulcer showed the presence of anthrax bacilli. He was refused admission to the hospital and referred to his own physician. Dr. Loeb called to see the patient the following day and found him dead.

The third case came under the charge of Dr. Ellis Given while a resident at the Episcopal Hospital. Dr. Given kindly

furnished me with the following notes. In May, 1900, J. McM., thirty-six years old, a wool-sorter, presented himself at the Episcopal Hospital dispensary. The point of infection was on the left forearm (Fig. 1), which was swollen; he had a temperature of $104\frac{1}{5}^{\circ}$ F.; pulse, 122; respiration, 35. He was denied admission at the Episcopal Hospital and referred to the Philadelphia Hospital. At the latter place he was treated by injecting pure carbolic acid about the ulcer. This patient recovered. Pure cultures of anthrax bacilli were obtained from this case.

CASE I.—The first case of my own which I wish to report came to my dispensary at the Episcopal Hospital on December 21, 1900. C. S., a robust German, twenty-one years old; for the past three months he has been working in a morocco factory. He said lately he has been handling goat-skins principally, and that most of the skins came from China. One week ago a small pimple appeared over his left eyebrow; this he squeezed with his fingers. Three days later he noticed the pimple getting red and larger. When I first saw the patient, which was about five days after he infected himself, he had a sore two centimetres by three centimetres over the left eyebrow. In the centre was a dark slough and about the margin, which was elevated, were papules and vesicles, there being a free discharge of serum from the latter. He had some œdema extending above the ulcer, also in temporal region, eyelids, cheek, and some slight œdema of the neck. (Fig. 2.) He said he had no pain, and complained merely of slight discomfort caused by the swelling. I could detect no enlargement of any glands. His temperature was $99\frac{1}{5}^{\circ}$ F. I suspected the case as one of anthrax, and an examination of the discharge by Dr. Ghiskey revealed the bacillus of anthrax in large numbers. The patient being refused admission at the hospital, I agreed to treat him at his home. The method of treatment was as follows: On the first day I injected twenty-five minims of pure (95 per cent.) carbolic acid about the periphery of the ulcer, introducing the needle at eight different points. He complained of some pain as the acid was injected, but this readily subsided as the tissues became anæsthetic. I saw no other ill effects from the acid. A wet bichloride of mercury (1 to 2000) dressing was placed over the ulcer, and hot applications ordered to be kept over the face. I instructed him as to the hygiene of the case. The following



FIG. 1.—Anthrax of forearm about thirty hours old. (Given.)

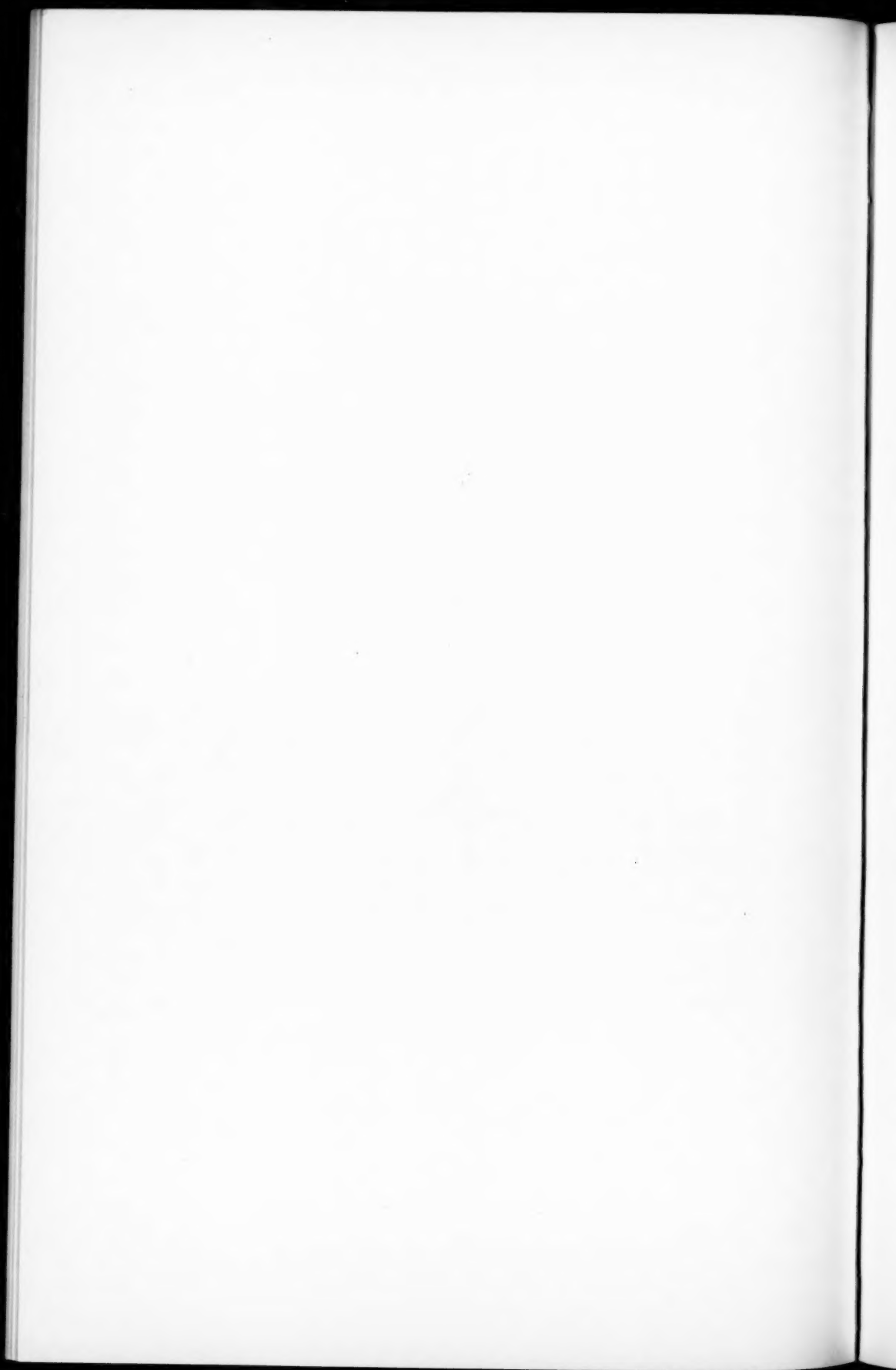
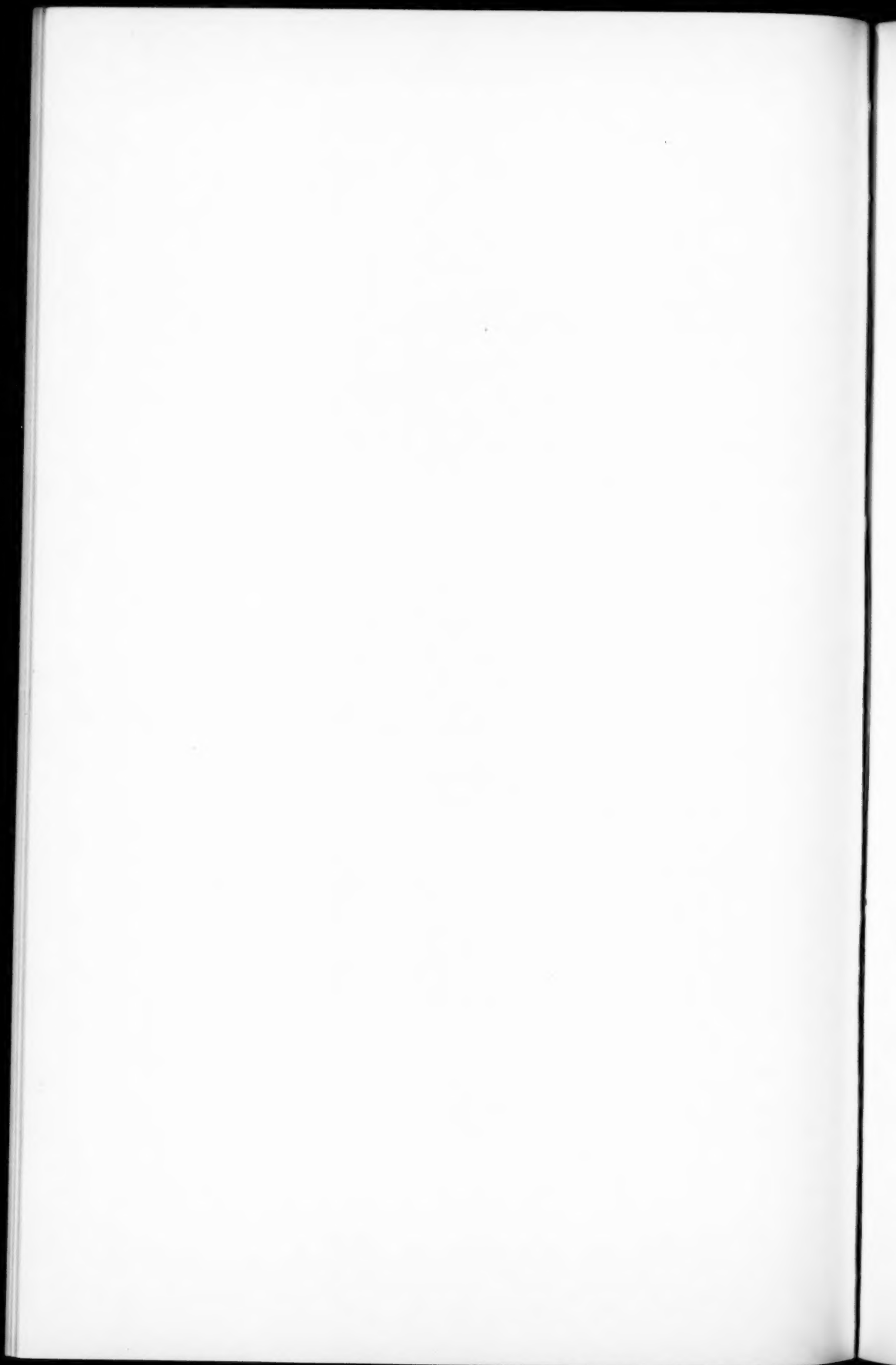




FIG. 2.—Anthrax of brow.



day the œdema was more extensive, his eye being entirely closed and the swelling of neck greater. The treatment of the previous day was repeated. On the third day the swelling had subsided somewhat, and the injections were omitted, the ulcer being dressed with the wet bichloride only. During the remainder of the course of the disease the bichloride dressings were continued. He received no internal medication. The slough separated in about three weeks, and when I last saw him, one week ago, he had a scar not as large as a quarter of a dollar over his brow; otherwise he seemed to be perfectly well.

CASE II.—My second case, although he is still under treatment, is so far along the road to recovery that I feel safe in reporting him as cured. He came to the Episcopal Hospital dispensary in April, 1901. As he was denied admission to the wards, the superintendent asked me to treat him at his home. I elicited the following history.

E. B., aged forty-four years, married, born in Poland. He is employed in a leather factory. Recently he has been working on goat-skins. He says the skins came from Russia. I first saw him on Saturday. One week previous he had a small red spot on his left upper eyelid. This grew rapidly, so that when he reported for work the following Monday his employer thought he had been fighting, and sent him home. He was treated at a drug store in his neighborhood, and when I first saw him, about one week after the commencement of the disease, he had the appearance shown in the photograph (Fig. 3). The picture shows fairly well the amount of the swelling. The œdema extended up into his scalp and down on to his neck. The distention was so great under the jaw that the patient asked me to incise it at this point, being under the impression that he had an abscess. The œdema was confined entirely to one side; it extended up to but not beyond the median line of the body. I could find no glandular enlargement in this case. His cheek was very red, firm, and had a few vesicles at different points, so that it looked not unlike erysipelas. The black slough which was originally on the upper lid had extended to the lower. Around the periphery of the slough there was an ugly, elevated margin of papules and vesicles, from which there was a copious discharge of serum. This patient, like the first, had no pain, and complained only of a sense of fulness in his head. He had a few chills; his temperature was not above 100° F. at any time I saw him. His sleep was dis-

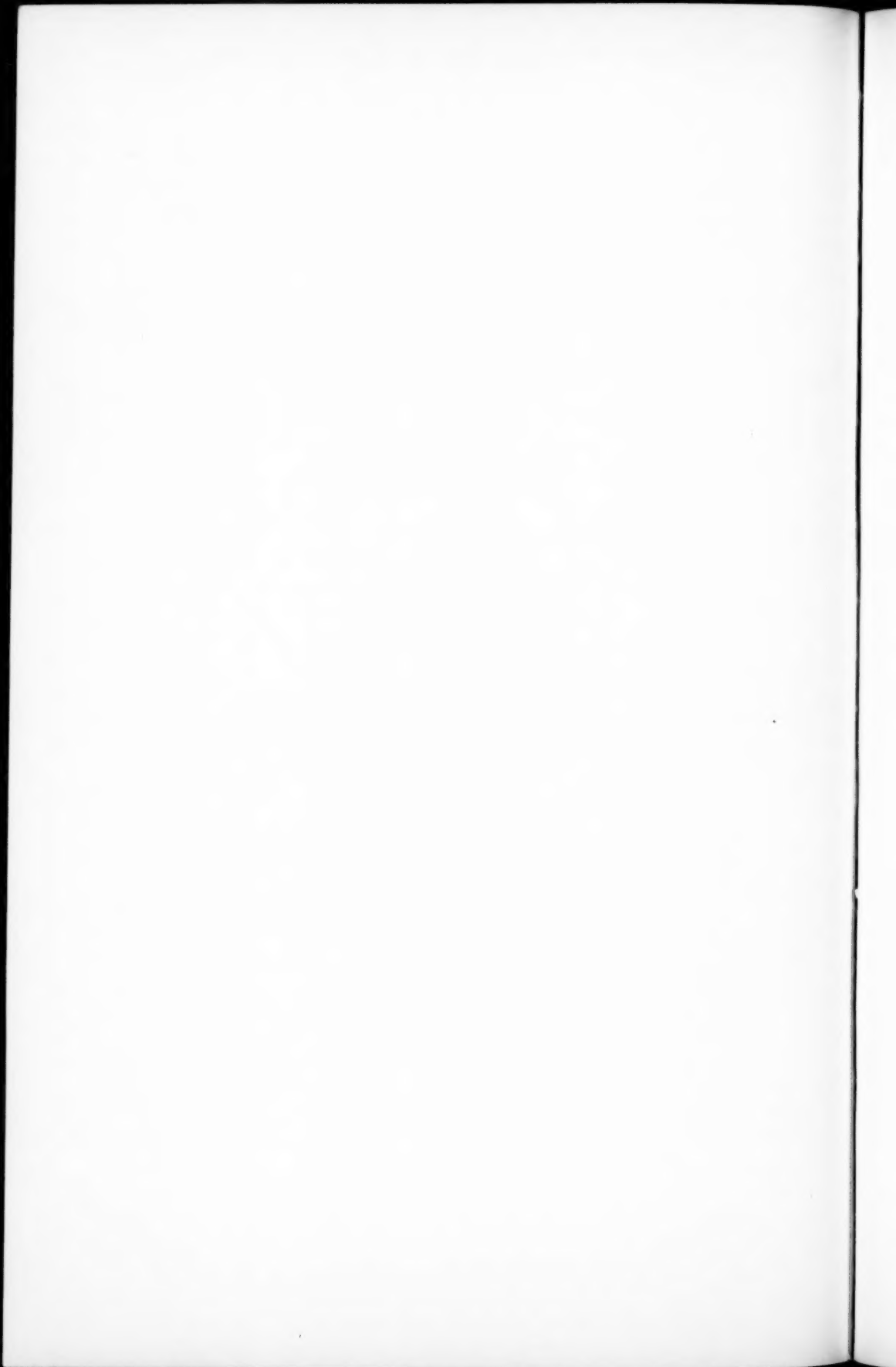
turbed, and when the disease was at its height there were a few nights that he did not sleep at all. Pure cultures of anthrax bacilli were obtained from this case. The first day I saw him I injected twenty-five minims of the pure carbolic acid at six different points of the base of the ulcer, and followed this by a wet bichloride of mercury (1 to 2000) dressing. This treatment was repeated the next day. The patient was advised to keep hot applications on the face. I saw him every day for one week, thereafter less frequently. The œdema gradually disappeared and the slough separated in about sixteen days. At present he has two granulating surfaces, one on each lid. There is a strip, about one centimetre wide, of healthy skin intervening between the sore and the free margin of the upper lid; the same condition exists on the lower lid. He will have some eversion of upper lid, also slight ectropion of lower. A thorough bacteriological study was made of these two cases by Dr. Ghriskey. The appended is Dr. Ghriskey's report.

Bacteriological report on the case of C. S. (Case I), referred to the clinical laboratory of the Protestant Episcopal Hospital for examination.

Cover-slip smear preparations were made from beneath surface of the lesion, the fluid obtained being rather clear serous. Agar-agar slants (Esmarch dilutions) and a bouillon tube were inoculated. The cover-slip preparations, stained with Löffler's alkaline methylene blue, showed microscopically the presence of polyneuclear leucocytes in fair number, and a few large bacilli deeply stained, singly, in pairs, and short chains with square ends and clear interspaces between the segments. Some involution forms were found, indifferently stained, and appearing as short and longer filaments. In several of the polymorphonuclear leucocytes were three and more bacilli. Numerous micrococci then were noted. All of the slant agar tubes, after twenty-four hours in the incubator, showed a universal surface growth. Smears from these tubes examined microscopically showed the presence of micrococci. The bouillon culture was diffusely opaque, and a small, tenacious growth was evident in bottom of tube when shaken. Cover-slip preparations from this showed long chains of a large bacillus, suggesting the *Bacillus anthracis* in its morphology. Inoculations with agar-agar (Petri plates) were made from the bouillon culture, and two organisms observed, a staphylococcus, later identified as the *Staphylococcus pyogenes aureus*, and a



FIG. 3.—Anthrax of eyelids.



bacillus; the latter, from subsequent inoculation in various culture media, was identified as the *Bacillus anthracis*. A white mouse, inoculated with this bacillus, was found dead after thirteen hours, and a pure culture from heart's blood was recovered.

[NOTE.—The above bacteriologist found spores on bacillus serum.]

In the case of E. B. (Case II), the *Bacillus anthracis* was very numerous in the smear preparations, being likewise found within the leucocytes, and was recovered as well as the *Staphylococcus pyogenes aureus* in pure culture from the primary cultures. This organism was virulent for white mice, the animal dying in less than twenty hours.

Bacteriological examination in case of J. McM., patient of Dr. Given.

Cover-slip preparations made from the clear serous fluid of vesicle stained with Löffler's blue showed the presence of large bacilli singly, in pairs, and short chains. Only stray polymorphonuclear leucocytes were seen, and none was observed enclosing bacilli. A bacillus was recovered in pure culture, and a detailed study was made. In its behavior in various culture media,—growing characteristically in gelatin,—stab inoculations, the microscopic appearance of the colonies, and the slow liquefaction of blood serum, the organism was found to be identical with the *Bacillus anthracis*. The agar-agar culture unfortunately died out during the writer's absence from the city, and no animal inoculations were made.

Doubtless there have been other cases of anthrax that have occurred in Philadelphia and never been recorded. Probably some of the cases of sudden death that have taken place in people employed in handling wool, hair, hides, etc., have been due to either pulmonary or intestinal anthrax. I trust this report will show the frequency of sporadic cases of anthrax in Philadelphia. As most of these cases can be traced to the direct importation of the disease from foreign countries, it is my intention to call the attention of the Department of Agriculture to the importance of establishing some form of disinfection on the class of imported animal products that is most liable to convey the disease.

THE X-RAY AND PHOTOGRAPHIC TECHNIQUE
NECESSARY TO BRING OUT BONE
DETAIL IN THE PRINT.

By EUGENE R. CORSON, M.D.,

OF SAVANNAH, GA.

MOST of the skiagraphs I see in the journals I judge to be from underexposed plates, because they show little more than bone outlines and nothing of the internal structure. In many even the medullary canal of the long bones cannot be seen. A lack of proper fixation of the part skiagraphed is also very evident in many skiagraphs. While in some cases it may not be necessary to have more than bone outlines, certainly in the majority of cases one should strive after all the detail possible. In the use of any scientific method of research, it should always be our aim to carry that method up to its perfected limits, and every worker with the X-ray should endeavor to bring out all that this wondrous new light can do for us.

Great progress in technique has been accomplished since 1895; so great, indeed, that what originally was a discovery in a branch of molecular physics has become a science in itself. We have found the conditions necessary for the different applications of this new method; that the conditions necessary for its use in internal medicine, that is, for the chest and the abdomen, differ greatly from those necessary in surgery and bone work. It is with this latter only that I wish to write here, and to show certain details in the technique necessary to get the best results.

In the November number of the *ANNALS OF SURGERY* for 1900 I published a series of skiagraphs showing the normal epiphyses at the thirteenth year. In this series I attempted to

bring out all the bone detail I could. It is very evident that it is just here, in the application of the X-ray to the study of normal anatomy, that all the detail possible should be brought out. Since then I have learned certain points in the technique which not only facilitate greatly the work, but also enable me to bring out even more of the detail in the print.

One of the great advances in X-ray efficiency was the discovery of the electrolytic break by Wehnelt. By it the amount of current going through the tube was enormously increased, and the time of exposure was correspondingly shortened. Its disadvantages were, the danger of ruining the tube except on very short exposures, and that the coil required a special construction to meet best the enormous frequency of the interruptions and the great increase of current. Donath, in his excellent work, has shown us how much can be accomplished by this method. Its special application to skiagraphy of the chest and abdomen, to the use of the X-ray in internal medicine, has been recently even more strikingly shown us by Professor H. v. Ziemssen and Professor H. Rieder in their "*Die Röntgengraphie in der inneren Medicin*," the first volume of which has just been published. The skiagraphs have been beautifully reproduced on copper by a heliotype process. They are all snap-shots, giving sharp outlines of the heart, arch of the aorta, the diaphragm, liver, and spleen; even the beginning branches of the bronchial tubes can be seen. Such perfect skiagraphs would be impossible with the ordinary interrupter and time exposure.

In skiagraphing the bones, however, this apparatus is not necessary. In fact, to get good bone detail, a certain time exposure becomes necessary, a length of time almost too great for the present constructed tube to stand with the electrolytic break. I have no doubt, however, that we shall have tubes capable of standing these strong currents with the electrolytic break sufficiently long to give us all the bone detail, and on much shorter exposures than are now necessary with the ordinary break.

I have an efficient apparatus for generating powerful

X-rays, a good fifteen-inch coil, with a large condenser capacity, energized by a large storage battery, with the Queen independent interrupter and the Queen self-regulating tube. With this apparatus I accomplish results which seem to be at least equal to what is done on the Continent in this particular line, and as most of the workers in this country are equipped much like myself, my experience may prove of some use here even should it have no wider usefulness. While for certain fluoroscopic work a form of static machine may be efficient, I feel quite sure that in skiagraphing the bones, where we must have heavy discharges with great penetration, the powerful coil is absolutely essential. The Germans will not listen to any other form of high potential generator, and I am sure they are right.

FIGURE 1.

Skiagraph of right adult elbow in complete extension, the extensor surface resting on the plate. (See Plate No. 27.) Tube eighteen inches from plate. Exposure, five minutes; in hydrochinon developer, five minutes; fixed in chrome-alum fixing-bath; washed two hours. In Carbutt's intensifying bath one and one-half minutes; washed again one-half hour; chloride of ammonium solution, 2.5 per cent., flowed over the plate; then placed in aqua ammoniæ solution until black; finally dried. Back of plate flowed with "Hance's Ground-glass Substance," and negative evened up by rubbing burnt umber into the thinner portions. Printed on carbon matt velox.

I believe in a long exposure, that is, long for a powerful coil. An X-ray exposure has a much wider limit than that for the camera and ordinary light. In other words, that while with the latter it is a question of seconds, with the former it is a question of minutes. With the Wehnelt interrupter the exposure approaches more that of ordinary sunlight, due naturally to the enormous frequency of the break and its suddenness, with the consequent increase of current. For example, with my coil, a negative of an elbow exposed five minutes does not differ much from one exposed seven minutes. I can see, however, that the shorter exposure is somewhat better. Of course it is easy to understand how, when the output of an apparatus increases greatly, the time of exposure becomes

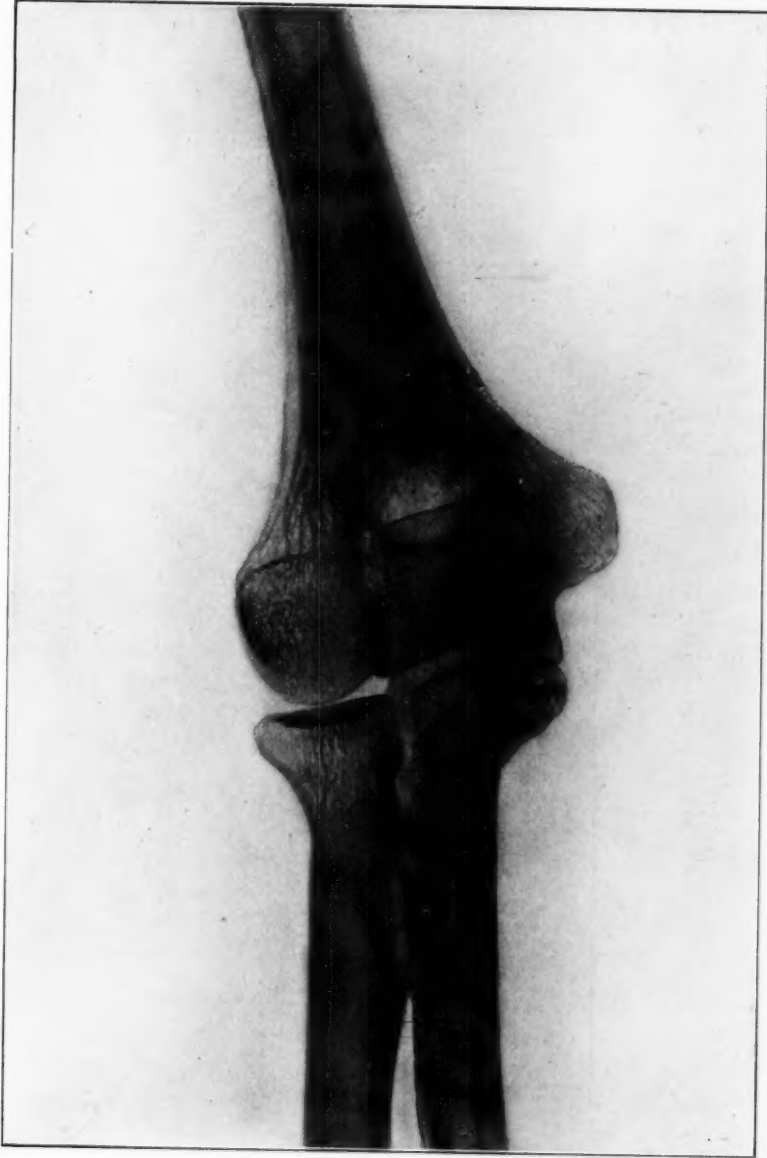
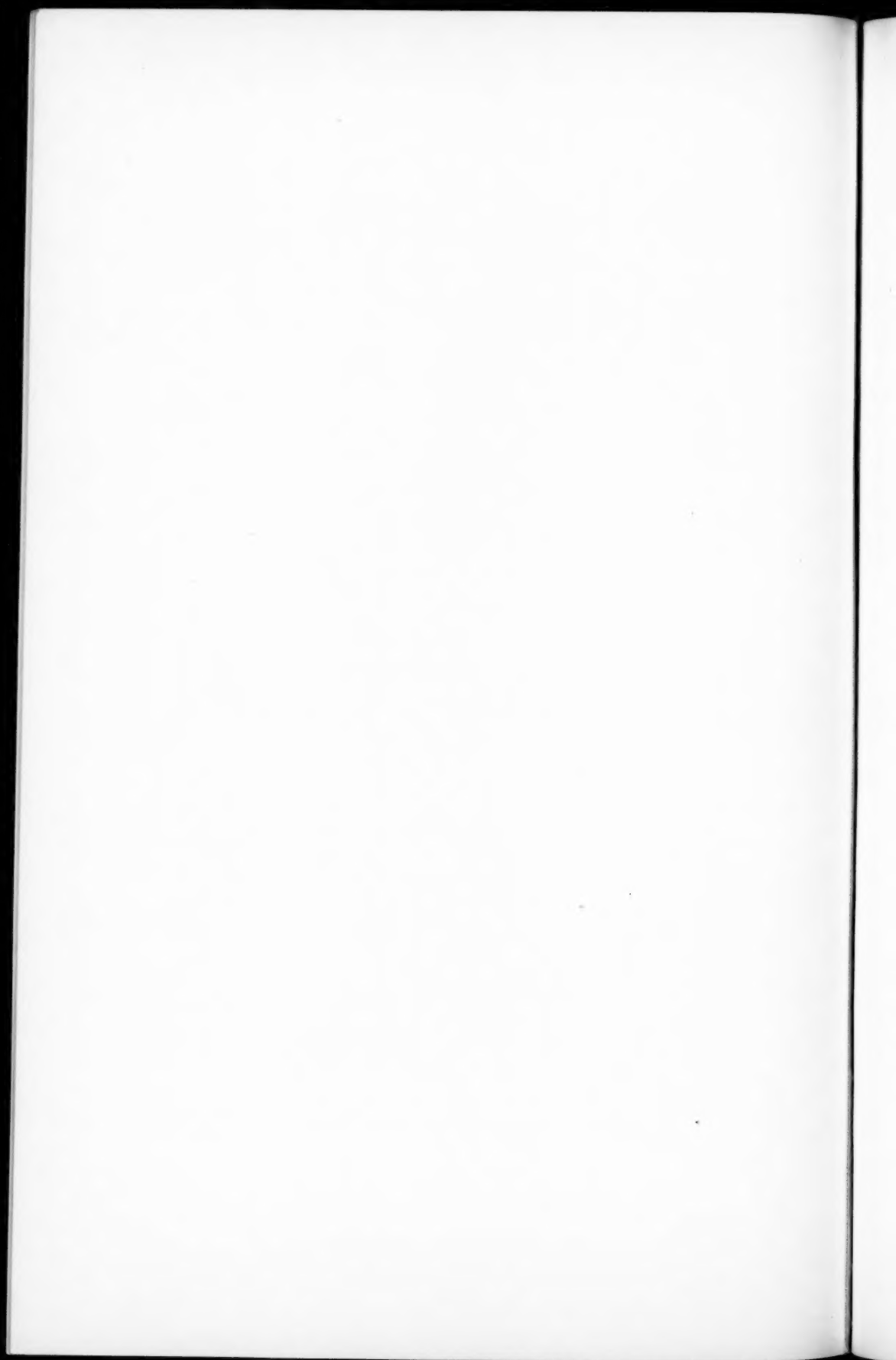


FIG. 1.



a much more delicate and vital point. Dr. Donath has shown us that with the electrolytic break the exposure is a question of seconds, and that a few extra seconds may ruin a plate.

My own exposures are sufficiently long to require a short development, rarely over five minutes, even with the excess of bromide in the developer. The development is carried to the point when the plate shows up black by the transmitted light of the dark room. The plate is washed two hours, then intensified in the corrosive sublimate bath,—Carbutt's formula,—washed one-half hour, and placed in the ammonia bath until black; finally dried.

I would repeat here advice given in a former paper to see to it that the part skiagraphed is bound firmly to the plate in order to bring the bones as close to the plate as possible, and to keep the parts absolutely still. This is especially necessary with an exposure lasting as long as five minutes. It is also well to place weights on the limb above and below the plate to prevent even the slightest movement from the arterial pulsation. This precaution will insure absolutely sharp negatives, especially necessary if we are after the internal detail. I see many skiagraphs which show a failure in carrying out this very necessary requisite for success, just as necessary here as in ordinary photography.

It is a notable fact that with the rapid improvement in X-ray efficiency and technique the skiagraph has improved so much over the original faint bone shadow that the artistic sense has been encouraged, and there is a very evident effort to make skiagraphs artistic and veritable illustrations, real anatomical figures. The coldest science when touched by the artistic spirit becomes warm. This laudable effort is more evident in Germany than here, and we have but to turn to the German X-ray journals, and to Ziemssen and Rieder's more recent work, to see how much has been done in this direction. In my X-ray work in normal anatomy I have tried to still further carry out this idea.

One of the disappointments in X-ray work is the great inferiority of the print compared with the negative. A good

sharp negative, with much of the bone detail, viewed by transmitted light, seems to leave nothing to be desired, and yet, when we print from this negative, disappointment is sure to follow. What is the main cause of this? It is because of the inequality of the negative, an inequality which does not exist to anything like the same extent in the ordinary camera negative. When there is but little difference in the thickness of the parts skiagraphed this inequality is slight; but if, as is usually the case, the thickness of the bones and soft parts varies much, the inequality in the negative becomes considerable, and is the disturbing factor in the printing, the thinner parts of the bone being overexposed in comparison with the thicker parts. You have a negative which is both dense and thin, and in attempting to print from such a negative, the denser portions are too faint, or do not appear at all, and the thinner parts are too dark, and in both cases the detail suffers; in the first instance

FIGURE 2.

An enlargement of Figure 1. A positive was made from the negative of Figure 1, and from this, using a "Carbutt A" plate, the enlarged negative was taken. Printed on "special portrait," matt velox.

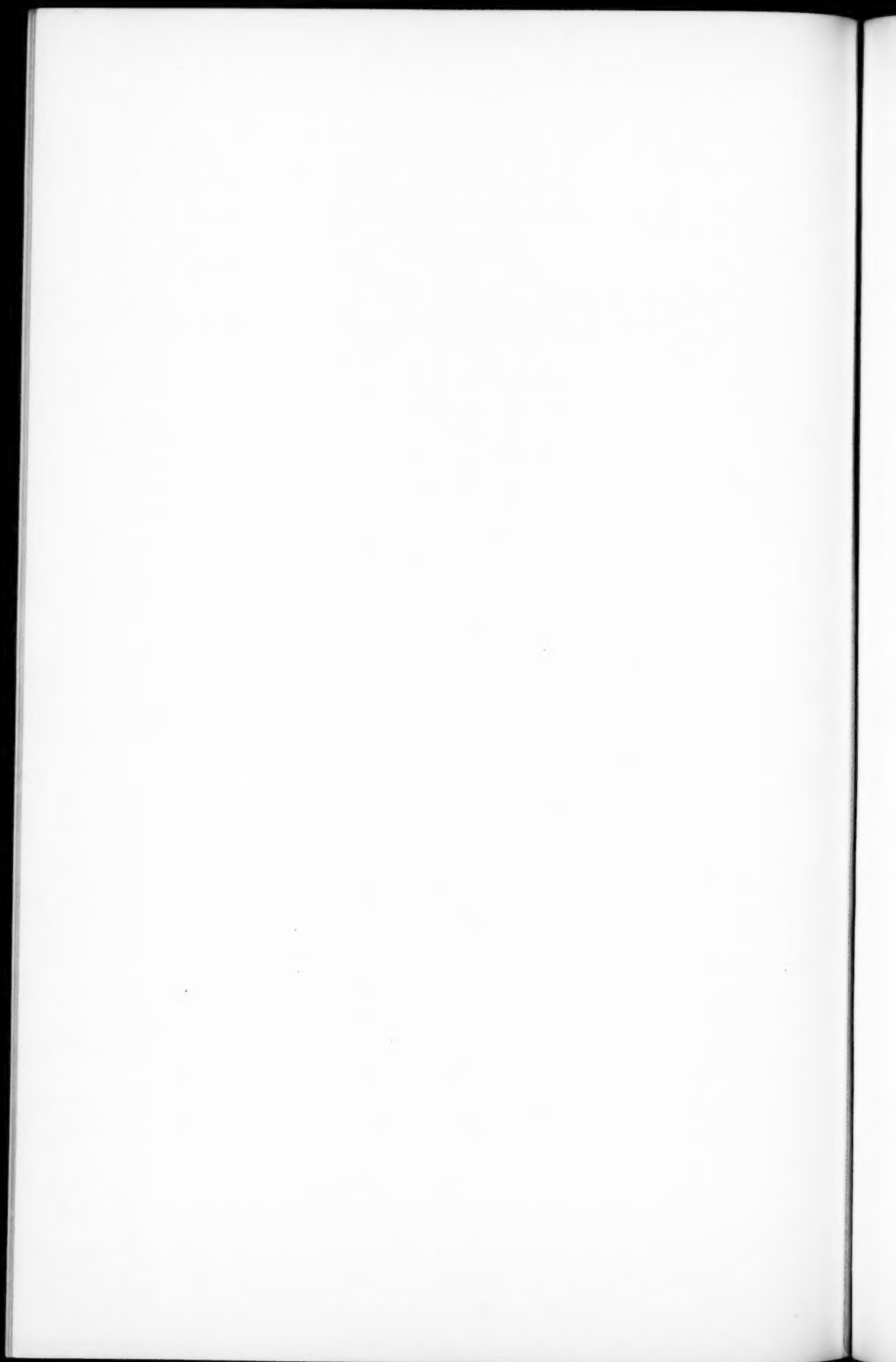
it is too faint, and in the second the detail is smothered up in the deep shadow. And, really, the finer your negative is, that is, the more detail you have, the more does this fault show up in the print.

For some time I have been trying to overcome this difficulty, and generally unsuccessfully. My usual method has been to use a shaded ground-glass screen, or, better still, the passing of the hand during the printing over the thinner parts of the negative to retard the printing at these points. This was the method used with my prints of the epiphyses; but it is very uncertain, very irksome, and much printing paper is wasted.

In some recent work I have made use of a photographic trick sometimes used by professionals in portrait work, which seems to me to have solved the problem. It consists in the following manœuvre. The back of the plate having been



FIG. 2.



cleaned of all spots and finger marks, it is evenly and carefully flowed with a preparation known as "Hance's Ground-glass Substitute," a solution of certain gum resins in ether. Great care must be taken to prevent the solution from running on to the film side, otherwise you may ruin your negative. This requires some little practice to do properly. I have found that if you will smear the edge of the plate with vaseline, you are less liable to meet with this unfortunate accident. This ether solution, of course, evaporates rapidly, leaving a very thin coating of gum resin, which adheres to the plate with great tenacity, presenting a surface difficult to distinguish from ground glass. You have now a surface into which you can rub any pigment and which will stick. With an artist's stub, such as is used in charcoal work, you carefully by transmitted light rub into the thinner parts of the negative burnt umber or burnt umber and yellow ochre. If properly done, you do not rub out the faintest hair-line of detail; you only retard the printing of the thinner portions; you simply even up your negative. It is well, before this process is undertaken, to take an ordinary print from the unprepared negative, and this will show you the inequalities and those portions which require the pigment backing to retard the printing. This process is also very valuable when you wish to make enlargements, difficult ordinarily on account of this same inequality. In this instance you can make a very even positive from which you get the enlarged negative, and which is just as even as the positive and the original negative. One can, of course, get an even negative of the same size as the original one by making a positive and from this a negative again, thus having a plate which requires no backing, and which can be preserved without the danger of the backing rubbing off, as in the first instance.

By this process, then, you obtain an even negative without touching the film side, and without changing in the slightest degree its detail. It admits of any amount of careful working up, for you can constantly test your backing by a print, lighting it here and making it denser there, until the print comes out with all the detail preserved, and with the

greater part of the beauty of the negative intact. Of course, there is a certain depth of film on the negative viewed by transmitted light which no print can give, but the real essential detail is there, just as in any ordinary photographic print.

I reproduce here two skiagraphs to show the result of this process. Fig. 1 is a coronal view of the elbow in complete extension. The film itself was never touched, and the print is absolutely untouched. The detail shown here would have been quite impossible without this equalizing process. The olecranon and parts of the humerus would have been too dark to have printed in the condyles. At least half the detail would have been smothered up in shadow. You have preserved the transparency of the bones so beautifully seen in the negative.

The second skiagraph is an enlargement of the first to bring the detail more in evidence and to give in larger and bolder lines the beautiful architecture of this joint. In copying the positive, the best plate to use is one known to the trade as a "Carbutt A" plate, a slow plate requiring several seconds in a good light. You get a negative of depth and brilliancy. Still greater enlargements on bromide paper produce fine pictures of this joint.

To the student of anatomy these figures must appeal as faithful representations of the bone relationships and of the internal bone structure, so essential to a clear understanding of bone and joint functions. They are veritable anatomical figures. To the surgeon they are of interest as giving us the correct lines and angles of arm and forearm, a normal from which to judge the deviations of cubitus varus and valgus, or, in fact, any deviations from the normal, resulting from injury or disease. Of course, this is from one plane only. I hope soon to publish a series of skiagraphs showing the sagittal as well as the coronal views of the elbow, from which we can get the completed picture of this joint, perhaps the most beautiful and most interesting joint in the body.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, April 24, 1901.

The Vice-President, F. KAMMERER, M.D., in the Chair.

INOPERABLE CANCER OF THE TONGUE, FLOOR OF THE MOUTH, AND JAW TREATED BY DOUBLE EXTERNAL CAROTID EXCISION.

DR. GEORGE EMERSON BREWER presented a man, aged fifty-one years, who was referred to the surgical department of Roosevelt Hospital by Dr. W. K. Simpson. For a number of months this patient had noticed a gradually increasing hardness on the left side of the tongue, with a certain amount of restriction of its movements. Various domestic remedies were tried, after which he consulted a number of physicians. When first seen by the writer there was a large, oblong, ulcerating mass about two inches in length along the left lateral border of the tongue, extending nearly to the median line, and involving the floor of the mouth from the region of the canine tooth to the tonsil, which was also markedly infiltrated. On the left side of the neck was a large mass of indurated glands completely filling the submaxillary triangle, and extending downward along the anterior border of the sternomastoid muscle to the region of the thyroid cartilage. A few isolated nodules were also found under the angle of the jaw on the right side. The man was thin, weak, and moderately cachectic. There was a constant drooling from the mouth of an extremely foul-smelling fluid. He was examined by a number of the surgical staff of the hospital, and the condition was considered by all to be inoperable.

On December 26 an incision was made along the anterior border of the sternomastoid muscle on the left side, and the glands, together with the areolar tissue of the submaxillary tri-

angle, entirely removed. The external carotid artery was then extirpated with ligation of all its branches, as suggested by Dr. Dawbarn. The operation was a long and difficult one, owing to the number of glands and large amount of infiltration. About two weeks later the second operation was performed on the right side. On this side, also, several glands were removed, and the artery extirpated in the same manner. The pathological report indicated that all the tissues removed, including the glands on the right side, were infiltrated with carcinoma. An infection occurred in the wound of the left side, but it healed after appropriate treatment. There has been a steady improvement in the man's condition. The floor of the mouth has softened considerably. A portion of the growth on the tongue has already sloughed off, and it seems that the larger mass now present will soon become separated. The man has gained considerably in flesh, the salivation has ceased, and he has resumed his work.

INOPERABLE CANCER OF THE LARYNX AND PHARYNX TREATED BY THE STARVATION METHOD.

DR. BREWER presented a man, aged thirty-nine years, who was also referred to him by Dr. W. K. Simpson. Following grippe, about four months ago, the man began to cough and present the evidences of a subacute laryngitis. The ordinary remedies were used without improvement in his condition. About three months after the onset of his symptoms, he was examined by Dr. Simpson, who found an epitheliomatous growth on the right arytenoid extending from this point to the epiglottis, base of the tongue, pyriform sinus, and lateral wall of the pharynx. There was thickening, also, of the left arytenoid. A portion of the growth was removed for examination and was pronounced epithelioma. As the growth extended to the middle line on the posterior wall of the pharynx, no operation could be devised for its complete removal which offered any chance of success. As its growth was extremely rapid, he was advised to submit to a palliative operation, which it was thought might arrest, temporarily at least, the progress of the disease. Accordingly, on March 18, under chloroform anæsthesia, an incision was made along the anterior border of the right sternomastoid muscle, exposing sev-

eral large glands. These were removed, together with the areolar tissue surrounding the superior thyroid vessels. The superior thyroid artery and vein and the lingual artery were doubly ligated, and a portion removed from each. The incision was then extended, and the inferior thyroid artery found and ligated as it passed under the common carotid. An incision was then made on the left side of the neck, and the superior thyroid and lingual vessels ligated.

He made a rapid recovery from the operation, and at the end of ten days announced that he had passed a restful night, having coughed less than at any time for three months. He was discharged from the hospital, and has since continued to improve. At the time of his last examination, on Tuesday last, the growth was found to have diminished largely in size and to be limited to a small area on the lateral pharyngeal wall, almost leading one to the conclusion that the extensive involvement observed by all was in part due to inflammatory induration. His cough has practically ceased, the hoarseness has improved, and he has gained rapidly in weight and strength.

DR. JOSEPH A. BLAKE, who had seen both of Dr. Brewer's cases before they were operated on, said they showed a marked improvement. In the first case, the growth was much decreased in size and the mobility of the tongue was greater; in the second case, the appearance of the larynx showed a remarkable change for the better, and there was much less involvement of the pharynx.

DR. ROBERT H. M. DAWBARN said that this operation of excision of both external carotids for inoperable cancer had now been done nearly fifty times, the first one (his own) dating back six and one-half years. While it was still too soon to formulate definite conclusions as to the ultimate value of the procedure, it can be said that it seems more permanently beneficial in sarcoma than in carcinoma; even in the latter class of cases, however, it is safe to predict that life will be prolonged by it for at least six months more than would otherwise be possible. In several of his cases of sarcoma, from two to six years have elapsed since the operation.

Dr. Dawbarn said that recently he did a partial autopsy in a case where this operation had been performed about four months ago for the relief of a very advanced case of carcinoma of the

lower jaw. The patient rapidly grew worse, however, and as a last resort the cancerous growth was extirpated. Death occurred thirty-six hours later from shock. The autopsy showed that after excision of both external carotids a collateral circulation in the growth may, perhaps more likely than by other routes, be established through the infraorbital branch of the internal maxillary which forms an indirect anastomosis, through the ophthalmic, between the internal carotid and the external carotid. It would perhaps be good surgery, in these cases, about a fortnight after the primary operation, to expose the infraorbital and occipital and temporal arteries under cocaine, and divide them. As to the first of these, a quite indirect connection which the facial has in this way with the internal carotid would be controlled. The occipital would be exposed near the mastoid process; the temporal at the zygoma. The speaker said that in his cases he had sometimes been unable to slip a ligature over the external carotid above its point of bifurcation into its terminal two branches. There is, hence, communication between the internal maxillary and the temporal; and at times, from the internal carotid to some extent through branches of the internal maxillary with the tumor. It would be a great help, in promoting the desired anæmia, to obstruct the internal maxillary and its branches. To this end Dr. J. A. Wyeth has suggested to the speaker either injecting boiling water, to cause obliterating endarteritis, or injecting melted paraffin, or some other mixture which would harden when cold, and leave the vessel and branches plugged. Dr. Wyeth has tried the hot water on a dog. The speaker is now working out the other idea—the paraffin, as being probably safer—at the Columbia University Physiological Laboratory, upon dogs, to determine, before trying it upon man, whether dangerous sloughing is likely to occur in consequence.

Dr. Dawbarn said that the operation of excision of the external carotids for cancer had now also been done by Drs. Brewer, Blake, Willy Meyer, Erdmann, Collins, and Lilienthal in this city; by Keen and Da Costa in Philadelphia, and by Nicholson in Atlanta. In conclusion, the speaker would remind the Society that, as extreme and permanent anæmia is the object to be accomplished, it is as important to save every vein exposed in the field, and even to avoid clotting in it by rough handling, as it is, upon

the other hand, to tie off and divide every possible artery and arteriole.

RESECTION OF THE INTERNAL JUGULAR VEIN FOR SINUS PHLEBITIS.

DR. WILLY MEYER presented a man, eighteen years of age, who came under the speaker's observation in February, 1899. He gave a history of ear trouble which had existed for one year, when it gave rise to septic symptoms. An aural surgeon was called, who trephined the right mastoid, and finding the antrum filled with pus, he continued the wound down to the dura mater and exposed the sinus, but at this point the patient became so weak that the operation was discontinued. A few days later he had a sudden chill, and developed an effusion into the sheath of the tendons of the right peronei muscles. An incision was made over the swelling by Dr. Meyer, and it was found that the sheath contained turbid serum. This was evacuated, but the patient did not improve, and subsequently he developed a marked swelling on the right side of the neck corresponding to the jugular vein, which gave rise to a good deal of pain.

Dr. Meyer was again called to see the case, and upon consultation it was decided to cut down on the internal jugular. The sinus of the old wound was first laid open, then the internal jugular vein was exposed. It was found to be much infiltrated, and upon incising it pus escaped. It was then followed downward into the subclavicular space as far as it was closed by thrombus. The occluded vein was then extirpated up to the jugular foramen and the wound tamponed. The patient made a good recovery from the operation, but three weeks later he developed an effusion into both pleural cavities, with symptoms of pyæmic (embolic) pneumonia. The pleural cavities were tapped several times, and considerable turbid serum withdrawn. After weeks of serious illness, under very careful nursing, he gradually recovered.

The patient still had a large cavity in the region of the right mastoid, and in July, 1900, Dr. Meyer chiselled through the bone and found a granulating mastoiditis; he did not lay open the antrum, but deepened the wound, and later covered the granulating surface with Thiersch's skin-grafts, all of which took very nicely. But a month afterwards the upper part of the grafts gave

way and the sinus remained open for some time. The patient was then seen by a number of ear specialists, and, finally, Dr. Meyer did the regular Stacke operation on the mastoid, which proved successful. The operation was followed by a temporary slight facial paralysis on the right side, but he is now entirely cured. The case, then, as such, represents recovery after true pyæmia following purulent otitis media with sinus thrombosis and its local pathologic manifestations.

EXTENSIVE VENTRAL HERNIA.

DR. WILLY MEYER presented a very stout woman, forty-five years old, upon whom a gynæcologist did a vaginal hysterectomy in 1894. Five weeks later he removed both her ovaries, and five weeks after that her left kidney was removed on account of its being, as she was told, a "floating kidney." Subsequent to these operations she developed a large ventral hernia, which proved rebellious to various appliances for its retention, and in 1898 Dr. Lange performed a very thorough operation for the purpose of closing it. There was no recurrence for about a year, when the cicatrix gave way while the woman was carrying a pail of coal up-stairs. The condition gave rise to a great deal of pain, and two years ago the woman applied to Dr. Meyer for relief. The hernia was very large, containing small and large intestine and omentum, and further operative interference did not offer much promise of success. He was finally induced to operate, however, by the patient's most urgent demand. Upon opening the hernial sac he found that the hernia retained the above-mentioned organs, matted together by many firm adhesions. After careful dissecting, they were finally reduced. The ring through which the intestines had escaped was perfectly round and very large. It could not be closed by the recti muscles. After complete reduction had been accomplished, the omentum, therefore, was pulled forward and stitched to this ring, thus forming a natural pad, which Dr. Meyer said he hoped would be strong enough to hold in the intestines when supported by an abdominal bandage. In this, however, he was disappointed, as it gave way at the lower pole about four months after the operation during an attack of gastroenteritis; there was considerable vomiting, and naturally the contractions

of the stomach pulled on the omentum and caused it to give way.

In another case of this kind, Dr. Meyer said, he intended to resort at once to the procedure which has been successfully used by Witzel and Schede, namely, the application of a silver-wire pad over the opening internally. He would probably also try it on this patient.

DR. F. LANGE said that in the operation done by him for the relief of the ventral hernia in this case, the two edges of the abdominal wall were brought together with considerable difficulty, and were united by three layers of buried sutures. The course of the wound, however, was not entirely aseptic; a sinus developed which persisted for some time, and some of the silkworm ligature came out. The tension of the wound was extreme, and some necrosis probably occurred.

Dr. Lange said this was not the only disappointment he had met with in the treatment of extreme ventral hernia in fat persons. In such patients vomiting after narcosis is especially apt to occur, and this may contribute to the final bad result. In these cases even secondary sutures are of comparatively little assistance. In future cases, the speaker said, he intended to make use of the silver-wire netting to which Dr. Meyer had referred. He had already resorted to this in several cases of extreme hernia, of both the ventral and inguinal type; but the operations had been done so recently that the final outcome was still uncertain. By employing these pads there was an absence of tension, and the wounds healed readily and without suppuration.

DR. F. KAMMERER said that during the past year he had seen three cases in which he was obliged to remove silver-wire matting which had been introduced into the tissues for the purpose of closing inguinal herniæ. In all the cases the wound had healed aseptically; but after a time infection occurred, the tissues had broken down, and fistulæ resulted. The speaker said he was aware of the fact that this method had been employed very successfully by certain European surgeons, but personally he was not inclined to resort to it in inguinal hernia. He, however, understood that the conditions were different in ventral hernia, where we often could not repair the damage without some such expedient. Still, it was well to remember that the wire would occasionally cause irritation.

DR. DAWBARN suggested the use of a celluloid plate, of about the thickness of the cover of a book, instead of a pad of wire netting. Holes could be drilled into the margin of this, through which the sutures could be passed. A celluloid plate, like that employed sometimes to fill bony gaps in skull-work, would have the advantage of being smooth, and it would probably be less apt to cause trouble than a pad of wire netting. When taken freshly from boiling water, celluloid is so soft that it can be whittled, as easily as pine, into the exact size and contour needed to fill the abdominal deficiency.

TUBERCULOSIS OF THE TESTIS.

DR. WILLY MEYER also presented a boy who entered the Post-Graduate Hospital last December. He gave a history of having had one of his testicles removed by a surgeon in Maine on account of sarcoma. Subsequently the opposite testis became involved, and the patient came on to New York to see if it could not be saved. The presence of a sinus, as well as the fact that both testes had been involved by the disease, rather militated against the diagnosis of sarcoma, and Dr. Meyer said he was at first rather inclined to believe that the condition was due to inherited syphilis. There was marked infiltration of the testicle and epididymis, with sinus-formation, which former rapidly disappeared under the use of iodide. The Bier method of treatment with passive hyperæmia was employed. To-day the sinuses are closed, and the infiltration of the epididymis is reduced, but still quite marked. Dr. Meyer said he was now practically convinced that the case was one of tuberculosis of the testis. The patient's doctor also had informed him that the removed testicle had been a tuberculous one.

DR. ELLSWORTH ELIOT, JR., said he thought that many cases of tubercular testis showed a natural tendency to improve, so far as the closing of the sinus was concerned and the sequestration of the cheesy tubercular material in the interior of the testis. The speaker said he did not mean to imply that the closure of the sinus in Dr. Meyer's case was not hastened by the application of Bier's method of treatment; at the same time, it recalled a case which was reported among other cases in the Presbyterian Hospital Reports a year or two ago. The case was that of a man with

bilateral tubercular disease of the testis, in which suppuration had taken place in both organs, with the formation of sinuses which healed spontaneously upon the application of iodoform ointment and the use of a suspensory bandage. The disease in that case had probably advanced farther than in the case shown by Dr. Meyer, as the lymphatic glands in the groin became infected and broke down on both sides. They were allowed to heal spontaneously after the tuberculous material was discharged. The patient, who was an orderly in the hospital on North Brothers' Island, eventually recovered, and has enjoyed good health ever since. He subsequently married, and within a year his wife was delivered of a healthy infant.

Dr. Eliot said that in many cases of tuberculosis of the testis the course of the disease is very slow. In some instances a rectal examination may throw some light on the diagnosis. The speaker said that in his case the cord was distinctly enlarged. It is very probable, when both testes are affected, that tuberculosis foci may be found in the seminal vessels.

TUMOR OF BLADDER REMOVED UNDER SPINAL ANÆSTHESIA.

DR. WILLY MEYER presented a man, sixty-four years old, who had suffered from hæmaturia during the past four years, having had three or four attacks of several weeks' duration each year. All the symptoms pointed to a tumor of the bladder, and with the cystoscope a growth about the size of a hazel-nut was distinctly made out in the region of the fundus, somewhat above the left ureteral mouth. This was seen bleeding during cystoscopy, a beautiful picture.

As the man was suffering from a severe chronic bronchitis, it was decided to operate under spinal anæsthesia. Two centigrammes of cocaine (equal to one-third of a grain) were introduced into the spinal canal, and this gave perfect anæsthesia. The bladder was opened and the tumor found without difficulty. There were two arteries supplying it, which were compressed by a catgut ligature passed around them by means of a curved needle. Then with a Paquelin cautery the growth was thoroughly shelled out. In closing the wound in the bladder, the bladder wall was doubly inverted about the tube, according to Voler's method of

gastrostomy, as advised by Dr. Gibson; but the bladder was not fixed to the abdominal wound. It was fully an hour after the completion of the operation before the patient had any sensation in the lower extremities. Subsequent to the operation he had a chill and high fever which persisted for six days. This unfavorable circumstance, Dr. Meyer said, he attributed to the effects of the cocaine, and this was one of the reasons why he preferred to use tropacocaine, which thus far he had never seen give rise to any unfavorable symptoms. One week after the operation, the tube was removed, and the wound closed within a very few days. There had been no leakage to speak of at any time.

DR. DAWBARN asked Dr. Meyer whether he had sterilized the tropacocaine before using it, and whether the drug tolerated boiling, without decomposition, better than cocaine. It is regarded by its makers as being in itself a mild antiseptic; but he questioned the wisdom of trusting alone to this alleged property in so dangerous a region as that of spinal anæsthesia.

DR. MEYER said he had used the tropacocaine in six cases without boiling it. He had dissolved it in a sterile salt solution, and thus far it had not given rise to any trouble. If it is possible to sterilize it, however, that should be done. Merck claims that it can be sterilized, and that a permanent solution can be prepared. The anæsthesia obtained after an injection of five centigrammes will last about one hour. In operations which take more time than this we can safely inject six centigrammes, or even seven or eight, of a one-per-cent. solution. It might be a wise precaution in all cases to first try it in the nose and pharynx, in order to ascertain whether any idiosyncrasy to the drug exists.

CHRONIC TENOSYNOVITIS.

DR. JOSEPH A. BLAKE presented a man, aged fifty years, who was admitted to the Roosevelt Hospital, March 25, 1901. For seven weeks he had had slight pain and swelling of the right wrist, and increasing disability. On admission he was unable to close his hand.

The house surgeon, Dr. Crawford, incised the swelling, and an amber-colored, friable, gelatinous tissue was found invading the palmar bursa, surrounding the tendons of the flexor carpi

radialis, the sublimis, and the innermost sheath of the profundis. The annular ligament was also involved. There were no rice bodies. The tissue was dissected out and the wound closed with the exception of a drain to the deeper parts. Healing followed, except for a small area of granulations where there had been necrosis of the skin. Motion is returning rapidly. The pathological report by Dr. Hodenpyl was chronic inflammation, no tubercle.

Dr. Blake said this case illustrated the difficulty of differentiating between simple chronic inflammation and the tubercular. The picture was typical of the tubercular form of tenosynovitis, with the exception that no rice bodies were felt. In this case, as well as in two cases of tubercular tenosynovitis which had come under his observation, the immediate result of operative treatment was good, and the patients were able to resume their usual occupations in a comparatively short time.

Dr. ELIOT said he had seen possibly a dozen cases of tubercular tenosynovitis, and in all of them the rice bodies to which Dr. Blake referred had been present. These cases may be roughly divided into two large groups, namely, those which are materially benefited by an operation, and those which are only slightly benefited. The first group includes those cases where the process is limited to the tendon sheaths; the second where the tendon itself is involved. The latter condition is rare, but it does take place. Improvement sometimes occurs under applications of iodoform preparations.

Dr. GEORGE WOOLSEY referred to a case of tenosynovitis affecting the extensor tendons of the toes in front of the ankle. In appearance, the condition was rather unlike that observed in cases affecting the tendons of the wrist; there was a large amount of connective-tissue growth and a comparatively small quantity of fluid. No rice bodies were found, but the pathologist pronounced the case of tubercular origin.

Dr. BLAKE, in closing, said that of five cases of extensive tenosynovitis that had come under his observation, the case reported was the only one in which no rice bodies were found. In the more typical cases the tendons over the metacarpal bones were much atrophied.

CERVICAL RIBS.

DR. FREDERICK KAMMERER read a paper with the above title, for which see November issue of the *ANNALS OF SURGERY*.

In connection with his paper, Dr. Kammerer presented the patient upon whom he had operated, and a radiograph taken subsequent to the operation.

DR. BLAKE said it seemed almost impossible that the subclavian artery could be compressed by a rib, as numerous dissections have shown that it is supported by the scaleni muscles above the first rib. There is a distinct fascia supporting the dome of the pleura, and the subclavian lies above this.

DR. BREWER reported the following case of cervical rib which occurred in his service at the City Hospital. The patient was admitted to the medical ward of the hospital with the diagnosis of rheumatism of the left arm. He had complained of pain in the left arm for a considerable period, and in addition to this there was numbness and some impairment of muscular power. A careful examination revealed a swelling in the supraclavicular space, which appeared to be an outgrowth from the transverse process of one of the lower cervical vertebræ, probably the seventh. At any rate, it was a bony growth, deeply situated in the supraclavicular space, and its presence there was immediately associated with the man's symptoms. A probable diagnosis of osteosarcoma was made, and an extensive operation for its removal was undertaken. A transverse incision was first made, extending just above the clavicle. This bone was then divided in the middle, and both ends everted. The presence of a supernumerary rib was then disclosed. It was attached to the seventh cervical vertebra, passing forward, and was attached anteriorly to the cartilaginous portion of the first rib by a distinct angular deflection. It was removed with considerable difficulty, and in the course of its removal the pleura was wounded, resulting in a pleurisy which did not prove serious.

After the removal of the rib, the man's symptoms increased rather than diminished. This was probably due to the fact that the operation was followed by a considerable formation of fibrous tissue, with cicatricial contraction. Both the muscular impairment and the pain in the arm persisted for a time, but subsequently the latter ceased, and there was a partial restoration of power in the limb.

DR. KAMMERER said there could be no doubt that pressure upon the plexus and the vessels was caused by the supernumerary rib, because the symptoms could not be explained otherwise. Whether the latter was in itself able to produce the effect, or whether an additional factor was at work, was an open question.

In regard to the sudden bend in the left clavicle seen in the X-ray picture between the middle and outer third of that bone, the speaker did not believe it indicated a previous fracture. He had examined the patient most carefully, and compared both clavicles. There was not the slightest indication that a fracture had ever occurred. No doubt the position of the patient during the taking of the picture was the cause of this apparent deviation at the point where naturally the middle and outer third of the bone meet in a curve.

URETERECTOMY; SECONDARY HÆMORRHAGE; IN-
TESTINAL HÆMORRHAGE DUE TO OLD
ULCERATIVE COLITIS; DEATH.

DR. F. LANGE reported the following case. A man, aged twenty-nine years, with negative family and personal histories, presented himself on account of an illness the origin of which was referred back three years, to an attack of renal colic. The subsequent illness, mainly loss of flesh and strength, lasted several weeks, but since then the patient has been in fairly good health. There have been no subjective symptoms. The urine, however, which was turbid for many months before the occurrence of the renal colic, has remained very turbid. The left kidney region is the site of a large, irregular, almost subcutaneous swelling, which, upon puncture, yields a clear, highly albuminous fluid in some places, and a thick pus in others.

October 29, 1900. After external urethrotomy, an examination of the bladder was made through the wound by means of the Kelly cystoscope.

On November 15, 1900, after an exploratory incision over right kidney, which showed that organ to be healthy, the left kidney was removed. After this operation there remained a fistulous tract to the stump of the ureter, which has discharged continuously. Urine also containing more or less pus. Thorough

scraping has had no effect. His general condition remained good, however, until February 1, 1901, when he began to have pain, elevation of temperature, and chills (*i.e.*, "retention-symptoms"). There is also an infiltration of considerable extent about the ureter.

February 22, 1901. Extirpation of the ureter was done. On the tenth day after the operation, there was a severe hæmorrhage from the lower (or bladder) angle of the wound; this hæmorrhage was checked by tampons. Twelve hours later, a second severe hæmorrhage occurred. The sutures were then removed, the wound entirely reopened, and the bleeding points ligated.

Between March 6 and 10 there were many liquid stools containing varying quantities of decomposed blood. This bowel hæmorrhage became more severe, and collapse occurred on March 10. The patient had suffered from digestive troubles for a long time, and shortly after the last operation he had presented an attack of what was taken for appendicitis, but was a colitis due to koprostasis in a diseased and ulcerated colon.

(*a*) Post-mortem examination revealed the presence of a large, solitary ulcer in the cæcum. There was complete destruction of the mucous membrane over an extent of fifteen centimetres, and partial destruction ten centimetres farther.

(*b*) Microscopic examination of the remaining kidney showed numerous areas of round-cell infiltration.

The character of the ulcerations in the large intestine is such that one must assume their existence for a long time. In some spots there are scars with islets of mucous membrane between. The ulcerations do not bear the type of tuberculous ulcers. The borders are not undermined, nor is the follicular apparatus the principal seat of the morbid changes. The hæmorrhages were perhaps caused by the hydræmic condition of the blood in consequence of the repeated hæmorrhages from the wound. The walls of the ureter are enormously thickened, and in some portions to about one centimetre. The canal irregular and partly ulcerated. The ureter and the ulcerated cæcum were presented.

NEPHROLITHOTOMY; HORSESHOE KIDNEY.

DR. LANGE also reported the history of a man, aged twenty-nine years, who came under his care March 28, 1901. For a year

and a half he had suffered from a constant dull pain in the right lumbar region, with frequent exacerbations. The urine had been very turbid, and had often contained blood. Three small calculi had been passed spontaneously, each preceded by an increased pain in his right side. The fourth attack of colic occurred in November, but no calculus was passed.

In November, 1900, cystoscopic examination revealed a solitary calculus in the bladder. This was crushed by the lithotrite, and the fragments removed by Bigelow aspirator. The stone was composed of acid urates, with a sharp, pyramid-like edge of calcium oxalate. The pain in the side still continuing, an X-ray photograph of the right kidney was taken in February, 1901, which gave a shadow of stone in right kidney.

March 29, 1901, a lumbar incision was made, and a large horseshoe-shaped kidney was found, lying with convexity downward; at the isthmus it was very adherent. To facilitate access to the kidney, it was necessary to remove the last rib. With great difficulty the kidney was exposed, the pelvis was explored, and the almond-like calculus located and removed. The incision into the pelvis of the kidney was made more difficult by the presence of renal arteries and veins both anteriorly and posteriorly to the pelvis. The incision was made anteriorly. The internal wound was partially sutured, and the pelvis drained. The ureter passed over the isthmus anteriorly. The duodenum touched the hilus behind and was for a short while thought to be the dilated pelvis of the kidney. Recovery was complicated by a pneumonia on the third day. Patient is now convalescent, and is doing well. An analogous abnormality is to be seen in Kuester's "Monograph on the Surgery of the Kidneys," page 115, Fig. 46.

NEPHRECTOMY FOR ACUTE SURGICAL KIDNEY; DOUBLE URETER.

DR. LANGE detailed the history of a man, aged fifty-six years, who came under his care in March, 1901. The origin of his illness was referred back three years. At this time patient had attacks of hæmaturia, and occasional sudden stoppage of urine-flow, accompanied by intense pain,—symptoms suggestive of calculus in the bladder. He soon recovered, however, without treatment, and remained well until three months ago, when he began to suffer

from frequency of urination. Six weeks ago a catheter was introduced into the bladder (probably for diagnosis), and the bladder irrigated. His symptoms, however, continued in spite of internal medical treatment, the urine being very turbid at this time, and two weeks ago an acute illness began. It was characterized by irregular chills, of long duration, at first once a day, later more frequent, followed by a sharp rise of temperature. There was usually no sweating. Vomiting occasionally occurred, but otherwise there were no general symptoms. Locally, there have been marked pain and tenderness over the left kidney, and occasionally along the ureter. This kidney seems somewhat enlarged on percussion, and the urine contains much pus and many casts. Patient was deeply septic.

On March 18, 1901, a brief cystoscopic examination was made. Beyond a marked trabecular condition of the bladder wall, nothing pathological was found. Guided by the enlargement, pain, and tenderness, Dr. Lange made an incision over the left kidney. To make it accessible, it was necessary to remove the last two ribs because of the length of the thorax. A very large adherent kidney was found, considerably discolored, its surface dotted with small abscesses. It was removed with difficulty. Besides the normal ureter, this kidney had a second ureter coming from the lower pole. This portion of the kidney was apparently obliterated by an old chronic process. Since operation, the septic symptoms have entirely disappeared, and the urine has become almost normal. A few hyaline and granular casts are occasionally found. A careful examination of the specimen does not show a communication between the main pelvis, which is located in the normal position, and the ureter at the lower pole, which had been sounded after being cut across and had been found unobstructed. The other ureter had not been sounded, it being secured in the mass ligature of the stump. The latter was short, and its deep situation and the weak condition of the patient contraindicated this procedure. Cystoscopically, one ureteral opening had been seen in about the normal location. There was during convalescence regurgitation of the urine through the lumbar incision for several weeks, principally coincident with the act of micturition.

DR. BREWER said he was interested in the case of double ureter reported by Dr. Lange. Abnormalities of the ureter, how-

ever, are more common than is ordinarily supposed, and the proportion that has been given, namely, 1 in 1000, is inaccurate. Dr. Brewer said that some years ago he made a critical examination of 150 subjects in the dissecting-room of the College of Physicians and Surgeons, and among that number he found three cases of complete double ureter, extending from the kidney to the bladder. In addition to this, he found six cases of partial double ureter emerging from the pelvis of the kidney.

DR. DAWBARN said that some years ago he exhibited at a meeting of the Surgical Society a specimen in which there were about a dozen ureters. There was no common sinus, each ureter opening into a tiny pelvis of its own, and subsequently a number of them joined near the bladder. This specimen is now in the Museum of the College of Physicians and Surgeons.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

The President, DE FOREST WILLARD, M.D., in the Chair.

Stated Meeting, April 1, 1901.

AMPUTATION AT THE HIP-JOINT FOR SARCOMA; THE TENDENCY TO RECURRENCE.

DR. JOHN A. WYETH read a paper with the above title, for which see page 375.

DR. W. W. KEEN said that the first thing that strikes one in connection with the subject of the paper was the great mortality, an experience which is not limited entirely to Dr. Wyeth or the cases he has collected in his paper. He had personally had four cases of sarcoma in the upper extremity and in the lower extremity two, one of which Dr. Wyeth had referred to. They were all operated on and all died. In three of those in the upper extremity, he removed not only the entire arm, but also the clavicle and scapula with it. The fourth was a very noticeable case, because of the rapidity of its growth. She was in Dr. Weir Mitchell's clinic at the Orthopædic Hospital, and suffered great pain at the upper end of the humerus, without any indication of any tumor whatever at first. But in the course of a short time a very small, ring-like tumor developed around the surgical neck of the humerus, which Dr. Keen diagnosticated as an osteosarcoma of endosteal origin, and advised amputation at the shoulder-joint. A delay of four or five days ensued, and in this short interval the tumor had perceptibly increased in size. The amputation at the shoulder-joint was done. She got along very well for a short time; then a universal sarcomatosis set in. When she died, there were over 100 tumors on the surface.

Of the two cases in the lower extremity to which Dr. Wyeth had referred, one was in the fifth month of pregnancy. She re-

covered after an operation at the hip-joint by Wyeth's method. She went to Texas, was successfully confined there, and returned to Brazil to her missionary work. Three and a half years afterwards she died from an internal recurrence; of the precise nature of it the speaker was not aware. The other was a case which Dr. Chalmers Da Costa had published. The patient came to Dr. Keen at the Jefferson Clinic, and Dr. Da Costa was asked to operate on in the clinic, as his was the next succeeding clinic and speed was necessary. In this case recurrence was noted almost immediately. It was especially interesting because the tumor was so high up that it invaded the groin, and it was not possible to apply the method of Wyeth. Accordingly, the abdomen was opened by Dr. Hearn. He compressed the right iliac through the abdomen, while the hip was disarticulated. She made a recovery from the operation, but died soon after from a speedy recurrence, so speedy that it might be called a continuation of the disease rather than a recurrence.

This certainly is a very mournful list. The question occurs, in view of these facts, is it desirable to operate on these patients or not? Distinctly, we should operate on them. Only 10 per cent., or thereabouts, die, as is shown by Dr. Wyeth's table, as the result of operation. A large number have certainly a prolonged life by reason of the amputation, the recurrence taking place at varying intervals, from a few months up to one, two, three, five years, and life is undoubtedly prolonged from what it would have been had no operation been performed. But more than that, not only is life prolonged but death is made a very much more comfortable process, if one may so speak of it; the recurrence almost always being in the internal organs, and therefore the foul discharges and very painful ulcers of the surface are avoided.

Dr. Keen was of opinion that no operation in continuity, as a rule, is allowable in these cases. If the reports of this large number of cases in which amputation at the hip-joint and at the shoulder-joint have been done are correct, and yet recurrence has taken place, it is perfectly clear that any amputation in continuity, even supposing the tumor to be in the lower end of the femur, is inadmissible. Amputation should be unhesitatingly at the hip-joint and not below the trochanters, as one is tempted to do. Thoroughness is the only possible way in which cure can be obtained. There are unquestionably a few cases which are cured for

a number of years, and possibly, so far as we can judge, permanently cured. A case that is cured for even one, two, or three years is rescued from an early grave, and, therefore, though the result as to cure is small in percentage, yet only by radical operation is even that small percentage possible.

Dr. Wyeth's suggestion of a deliberate erysipelas infection is a very good one. The only question that would arise is whether it ought to be a primary infection at the time of operation, when the fatality would be very considerable; or whether it would not be better that the surgeon should strive for an aseptic operation for immediate cure, and then, as has been narrated in some of the cases, a deliberate secondary infection even with the erysipelas streptococcus itself. The results shown in Dr. Wyeth's personal cases have been such as to lead to the hope that this is a possibility; and although the percentages that Dr. Coley has reported to us are not large, yet they are encouraging.

Dr. Keen said that recently a child of six years, with a very extensive sarcoma of the soft parts of the right thigh, had been brought to his clinic. The child had already been operated at the Polyclinic by the younger Morton, but recurrence had followed. Dr. Keen was very much disinclined to operate because the child was in a wretched general condition, but the point that decided him positively against it was the one that he desired to emphasize.

About six years ago, Dr. Chalmers Da Costa published a paper, of greater importance than the profession have thus far recognized, on the effect of ether as an anæsthetic on the hæmoglobin. He showed by a number of cases that the administration of ether, no matter for what purpose,—even without operation, and therefore when the loss of blood could not have influenced the loss of hæmoglobin,—diminished the amount of hæmoglobin very perceptibly. Mikulicz also has called attention to this, and recently in the *ANNALS OF SURGERY* an admirable paper by Hamilton Fish was published, in which he has borne testimony to the same effect. Mikulicz has stated that if the hæmoglobin is below 30 per cent., and ether is administered, the patient is in great danger, as the administration of ether diminishes the hæmoglobin by 10 to 20 per cent., which will make it impossible for oxygenation to go on, and therefore will invite death. In the case of this child, when he investigated the

hæmoglobin, he found it was down to 45 per cent., and he rejected operation at once. He thought the rule that is proposed by Fish and by Da Costa, that we are not to operate on any case in which the hæmoglobin is below 50 per cent., is correct, and that where the hæmoglobin is below 30 per cent. we are very apt to have death on the table.

DR. WILLIAM B. COLEY said that the first patient whom he had subjected to amputation at the hip-joint was a girl, aged eleven years, with a large, acute, traumatic, spindle-celled, periosteal sarcoma of the femur. The operation was performed at the New York Post-Graduate Hospital on July 25, 1897. The patient made an excellent recovery, the wound healing by first intention. The later history of this case he had been unable to trace.

His second case was also a periosteal sarcoma of the femur, occurring in a boy aged six years. The tumor was of exceedingly rapid growth, and, although when first seen by himself in May, 1898, amputation at the hip-joint was strongly advised, the parents did not consent to an operation until the following September, and then only after a portion of the tumor had been removed by the family physician and the diagnosis of sarcoma was confirmed by microscopic examination. The tumor at that time extended over nearly the entire length of the femur. The child was considerably emaciated, and it was very doubtful whether he would survive the operation. He performed amputation on September 9, 1898, the operation being completed in thirty-three minutes. Not more than a drachm of blood was lost, and there was practically no shock following the operation. About two months later the disease recurred in the abdomen and lungs, and caused death about six months after operation.

His third case was a girl, thirteen years of age, with a chondrosarcoma of the femur. The tumor was first noticed in January, 1898, and was comparatively small when he operated on June 2, 1898. There was practically no blood lost, and the patient made an excellent recovery. The small size of the tumor, together with the fact that the growth was a chondrosarcoma, made up largely of cartilage, further, the fact that the operation was performed within six months from the discovery of the tumor, all seemed to make the prognosis extremely hopeful. The patient, however, after remaining well for about a year, began to slowly emaciate, and died one and a half years after operation from generalization of the disease.

His fourth patient was a man, aged forty-nine years, with a recurrent, spindle-celled sarcoma of the left thigh, originating in the fascia. The growth extended nearly to Scarpa's triangle, and operation was much more difficult than in the preceding case. Amputation was performed on the 15th of October, 1898. The patient made an uninterrupted recovery, but after remaining well for one and a half years, local recurrence set in, which, he believes, proved fatal the following year.

His fifth patient was a young lady, twenty-four years of age, with recurrent, spindle-celled sarcoma of the fascia and muscles of the thigh. The erysipelas toxins were tried prior to amputation, with the result that the growth apparently disappeared and the patient left the hospital. After a few months local recurrence followed, and he performed amputation at the hip-joint. In this case there was some sloughing of the flap, which caused some delay in the wound healing. The patient has remained in perfect health up to the present time. Examination made a few days ago showed no evidence of local or general recurrence.

His last patient was a blacksmith, forty-five years old, with acute traumatic periosteal sarcoma of the femur, following the kick of a horse in January, 1900. A tumor developed at the site of the fracture almost immediately after union, and continued to increase in size up to August 10, 1900, the time of his first observation. The diagnosis of sarcoma being at that time unmistakable, immediate amputation was advised, without preliminary exploratory incision. The operation was performed on August 19, 1900, and, although the patient's general condition was far from good,—he was suffering from valvular disease of the heart,—he nevertheless made an excellent recovery. After returning to his home, Dr. Coley advised long-continued treatment with the mixed toxins, which treatment is now being carried out by his family physician, who states that the patient has remained in good health up to the present time, there being no signs of return. While the operation in this case was practically bloodless, he omitted the precaution he had observed in all the other cases, namely, of slowly releasing the rubber tubing after all the vessels that were visible had been tied, and there was some loss of blood from a vessel that had retracted underneath a muscle in the region of the acetabulum.

Dr. Coley believes that Dr. Wyeth, in his earlier paper, advo-

cated closing the wound and applying the dressing before releasing the rubber tubing. If this procedure had been followed in his own cases, he was certain that in at least two death would have resulted from hæmorrhage. It is better that the tube should always be released slowly, and every vessel should be clamped and tied before closing the wound, relying in no way upon pressure. The shock after operation was in no case very marked, and the condition of the patient never called for infusion.

The striking decrease in the mortality of hip-joint amputation has been largely due to better means of controlling hæmorrhage; and of all the methods that have been devised up to the present time, he believes that Dr. Wyeth's, for simplicity and effectiveness, is by far the best. Butlin's statistics show that of forty-seven cases of sarcoma of the femur in which amputation of the hip-joint was performed, 25 per cent. died of the operation; although it is only fair to state that his later collection of cases, twenty-four in number, shows a mortality of but 12 per cent. against 25 per cent. in the earlier series.

Dr. Coley strongly protested against the custom of many good surgeons of exploring a sarcoma of the femur and removing a portion for microscopical examination. He was convinced that this procedure, especially in a tumor of high vascularity, is fraught with grave peril to the patient by reason of the chance of some of the infectious agent, be it a micro-organism or an infected cell, being carried to other parts of the body. He had observed very rapid generalization of the disease follow such exploration, and he had given it up. In case of doubt—and in early cases there may be doubt—the best plan is to prepare the patient for an operation, and, after the tourniquet has been applied, the tumor can be cut into, and the gross appearance will rarely, if ever, leave the diagnosis still in doubt; a frozen section could be made if need be.

In addition to the six cases of sarcoma of the femur or thigh treated by amputation at the hip-joint, he had had three other cases of sarcoma in which he performed amputation of the thigh just below the trochanter, all by Wyeth's method. In two of these the disease was a periosteal sarcoma of the femur, and the third a mixed cell sarcoma, originating in the soft parts. One of the patients, with a periosteal growth, died four months after operation, from metastases in the lungs. The second is now well one

and a half years after operation, though another operation will remove the remaining portion of the femur, has just been performed by Dr. I. D. Bloom, presumably for recurrence. The third (soft parts) recurred in the glands of the groin, and died four months after operation.

In the case of periosteal sarcoma that died four months after operation, no toxins were used. In the second case, alive and well one and a half years after operation, and just operated upon, the toxins were used both prior to and for a considerable period after amputation as a prophylactic. In the third, with sarcoma of the soft parts, the toxins were used prior to amputation for a local recurrence with little apparent effect.

While he had had no deaths from operation in any of these nine cases of sarcoma of the femur and thigh, the final results, especially in those in which the toxins were not used after amputation, are exceedingly discouraging, and go far towards confirming the opinion of Butlin as to the hopelessness of sarcoma of the femur, even when treated with the most radical measure. Of Butlin's collection of sixty-eight cases of sarcoma of the femur treated by hip-joint or high amputation, only one was known to have remained well beyond three years.

One patient whom he saw in consultation some four years ago, a girl of thirteen, with periosteal sarcoma of the femur, and in which he advised amputation at the hip-joint, was operated upon by Dr. J. D. Rushmore, of Brooklyn, and has remained well over three years. The only other successful cases that he knew of are, first, the patient operated upon by Dr. Geo. F. Shrady, eighteen years ago, by high amputation. The patient is still in good health. Dr. Shrady is unable to state whether the sarcoma was of central or periosteal origin; but the diagnosis was confirmed by microscopical examination, and there is no question as to the nature of the disease; and, second, the case reported by Reinhard. Even adding these three successful cases to Butlin's and those which Dr. Wyeth has been able to collect, it is clear that, in sarcoma of the femur, especially if of periosteal origin, we have to deal with a disease of the most malignant type known, and one which, in the majority of cases, has proven beyond the power of surgical resources to combat.

As to what may be expected from the toxins in these cases, while thus far there have been no cases of sarcoma of the femur

cured by the toxins alone, there have been five cases of sarcoma in other long bones successfully treated,—three of the tibia, one of the fibula, and one of the radius. Only one of these cases was treated by Dr. Coley. This was a spindle-celled sarcoma of the tibia. The tumor was recurrent, and the diagnosis had been confirmed by Dr. John Caven, Professor of Pathology at the University of Toronto. The patient is well and in perfect health at the present time, two and one-half years after treatment.

He was of opinion that, instead of adopting the plan advocated by Dr. Wyeth, of using the toxins immediately after operation, before the wound has healed, the better way would be to strive for aseptic wound healing, and then, as soon as the patient had fully recovered from the operation, for example, three to four weeks later, give systematic injections of the mixed toxins for a considerable period of time, say one to two years, with occasional intervals of rest. In such a case he should advise much smaller doses than in cases in which a tumor actually exists, aiming to get only a slight reaction. Such treatment could be easily carried out by the family physician, and it would not confine the patient to bed.

The evidence in proof of the value of the toxins in preventing the recurrence of sarcoma, and even carcinoma, is slowly but surely increasing. The following are a few of the most striking examples:

Recurrent spindle-celled sarcoma of the leg and popliteal region (three times recurrent) disappeared under the prolonged use of the toxins; then recurred. Amputation at the middle of the thigh was performed, but the disease quickly recurred in the gluteal region and was entirely inoperable. Further treatment with the toxins caused a decrease in the size of the tumor, so that it was possible to remove most of it by operation. The patient was kept steadily upon the toxin treatment for more than a year afterwards; she has remained perfectly well up to the present time, four years afterwards.

Another most convincing case is that of a physician with an eight times recurrent sarcoma of the soft parts of the chest wall. The growths were recurring very rapidly and increasing in malignancy. He received injections of the toxins for nearly three and a half years, and is now in perfect health, without any signs of recurrence, nearly seven years from the beginning and four years from the cessation of the treatment.

He could cite other similar examples did time permit, but these will suffice to prove that the toxins, when persistently used, furnish us a valuable means of prophylaxis against recurrence.

Williams's collection of cases of sarcoma showed 29 per cent. of sarcoma of the bones and a considerable number of sarcoma of the femur. Of 320 cases of sarcoma he had personally observed, 25 per cent. were sarcoma of the bones, of which fourteen were sarcoma of the femur. Dr. Coley endorsed strongly the position taken by Dr. Keen, that, in spite of the very discouraging statistics, operation should be advocated. The first case of sarcoma of the femur he observed after leaving hospital was in a patient who refused operation, and whom he followed until she died. The death was infinitely distressing. The profuse discharges, the inflammation, and the foul sloughing that occurred, made the death from that recurrence following an operation infinitely preferable.

As to treatment with toxins. At the same time that he performed many of these operations for sarcoma of the femur, he had not made it the practice of using toxins as a prophylactic measure after amputation. During the last year or more he had been advocating the toxin after all operations for sarcoma, not at the time of wound healing. He thought the position taken by Dr. Keen to be the better one, that of getting the patient over the operation in the way of aseptic wound healing. But after the wound healing has taken place, he would adopt the suggestion advocated by Dr. Wyeth, or a course that is preferable, viz., putting the patient upon a continued systematic treatment with the mixed toxins for at least one or two years after operation. The treatment should be given for one or two months at a time, giving the milder doses, not causing the high temperatures, but getting a mild reaction, and not in any way preventing the patient from attending to his or her duties.

As bearing upon the value of such treatment, he cited a few cases in which the toxins had been used as prophylactic treatment. One was an especially interesting case, being a sarcoma which started in the bones of the foot; operated upon originally by Dr. Bull, and later by himself in 1894. The foot was first removed by Dr. Bull, and afterwards he also removed a tumor—size of a child's head—in the popliteal space and thigh. The tumor recurred locally, and after having disappeared with the toxins,

recurred a year and a half later in the stump; a high amputation just below the trochanter was done, and about a year later the disease recurred in the gluteal region, a place where it could be no longer removed. Then the patient was put on systematic treatment with toxins for about a year by himself, and later the treatment was carried on by Dr. Risk, of Summit, New Jersey. He had a recent letter from her stating that she was still in perfect health, more than four years after she was treated by himself and two years after all treatment had been left off. In another case, of a spindle-cell sarcoma of the soft parts of the chest occurring in a well-known surgeon not far from New York, he had eight operations for this disease, and the recurrences were taking place at shorter and shorter intervals, and, from any other stand-point than the toxin treatment, the patient seemed absolutely hopeless. The growths were changing in character from fibrous spindle-celled until they had become almost entirely round-celled and very vascular, and the round cells predominated. Toxins were given to this patient for a space of nearly four years at small intervals, part of the time by Dr. Coley and part of the time by the surgeon's assistant, in such small doses that he was able to continue his work all the time. He has had no treatment for nearly four years. He weighs 190 pounds and is still in perfect health. He could mention other similar cases did time permit.

Dr. Coley did not claim that the toxins will cure all cases, or even most cases, but that a sufficient number have been cured to make it worth while to give these hopeless patients the benefit of the only chances of life. As to final results, he stated that in the older cases, prior to 1898, fifteen remained well from three to eight years. All of these cases were hopeless and inoperable, and in all but two the diagnoses were proved by microscopical examination in the hands of competent microscopists. The other two cases in which the examination was not made were cases in which the clinical aspects of tumor with a history of repeated recurrences placed the diagnosis beyond any reasonable doubt.

These are but a few cases compared with the large number (140) treated, but of cases of spindle-cell nearly 50 per cent. have yielded to treatment. Of the successful cases treated by this method in the hands of other men, ten were round-celled; four cases of round-cell sarcoma have been treated with success, one being a round-cell sarcoma of the lip occurring in a little girl five

years of age. The disease disappeared, and the child has remained in perfect health four years after treatment.

He had had one case of sarcoma of tibia, recurrent spindle celled, treated with success, and the patient is now well, nearly two and a half years. Amputation was avoided, and the leg is perfectly strong.

DR. DEEVER said that in view of the frightful mortality of this disease, why would it not be better not to close the wound, but treat it as an open wound and infect it immediately? If cure can be brought about in this way, it is justified. His experience with amputation of the shoulder-joint had been limited. He had amputated for sarcoma at the shoulder and hip-joint in two cases; both died within a year. Another case he referred to in which Dr. Keen was associated with his brother, Dr. H. C. Deaver. That case involved the whole of the upper extremity. The patient died with sarcoma within a year. He recently had seen a case, that Dr. Coley had also seen of sarcoma of the neck and of the jaw, in which there had been several operations. He had seen her recently, and believed her now to be attacked with sarcoma of the mediastinum. With osteosarcomata of the jaw his experience had been more satisfactory.

DR. BLOODGOOD said that within the last few months he had studied carefully all the cases of sarcoma of bone which had been observed in Professor Halsted's clinic from the opening of the hospital in 1889 to the present day; the ultimate results had been encouraging. The relation between the character of the tumor and the ultimate result impresses one that there is a difference in the malignancy in the different sarcoma of bone. This seems especially true of those cases of sarcoma which are made up chiefly of giant cells. König ("Text-Book on Surgery") called attention to this many years ago, and claims to have cured a number of cases by curetting or chiselling of the tumor only. Karewski (*Berliner klinische Wochenschrift*, August, 1898) and Hinds (*British Medical Journal*, February 26, 1898) each report a case of giant-cell sarcoma situated in medullary cavity apparently cured by chiselling.

Although many authorities agree with Dr. Wyeth in performing an amputation at the highest joint for every case of sarcoma of bone, yet there are a number of authorities whose experience has taught them that, in many cases of sarcoma of the

long bones, resection rather than amputation will yield equally good results. Mikulicz first advocated this in 1895 (*Archiv für klinische Chirurgie*, 1895, Band i, p. 661). Weisinger (*Deutsche medicinische Wochenschrift*, October, 1898), reporting a number of cases of resection for malignant sarcoma of the long bones, refers to Mikulicz's previous article, and agrees with his conclusions. Morton (*British Medical Journal*, July 23, 1898) and Karewski (*Berliner klinische Wochenschrift*, August 22, 1898) also report cases of resection for malignant sarcoma of the long bones. All authorities seem to argue that the chief danger in sarcoma of the bone is internal metastasis, and that local recurrence is uncommon even when the low amputation or a resection is performed. Dr. Wyeth's cases demonstrate this. The higher amputation, of course, cannot give immunity to internal metastasis; and if further experience demonstrates that the lower amputation, or, better, the resection, gives equal immunity to local recurrence, such operations, of course, give the patient more useful limbs in both upper and lower extremity. In some of Mikulicz's cases, ten centimetres of the femur or tibia were resected; bony union and a very serviceable limb resulted. In the upper extremity extensive resection, although it leaves a flail joint, yet the patients are able to use their hands to great advantage. One of Halsted's earliest cases demonstrated this. The patient was a colored woman. About seven years ago, seven centimetres of the radius and ulna, including the wrist-joint articulation, were resected. The tumor was a pure giant-cell sarcoma, originating in the periosteum, but had infiltrated the medullary cavity of the ulna bone and some of the surrounding muscles. The patient is living and well to-day, and earns a living by ironing.

Of course, as Mikulicz wrote some years ago, the earlier we operate in sarcoma of bone the better are the chances for a complete removal of the disease by resection.

A greater number of cases, however, observed over a period of at least six years, must be collected before the question of resection rather than amputation for sarcoma of the long bones can be settled. His own limited experience in the clinical observation and pathological study forced him to agree with König and other authorities that there is a difference in the malignancy of sarcoma of bone. These less malignant tumors can be recognized at operation by the gross pathological picture, and these tumors can be cured by less extensive operation. Mikulicz's and Weis-

inger's position, that even the most malignant sarcoma of bone, even if the tumor has infiltrated into the surrounding muscles, can be cured by resection, is not yet confirmed; but nevertheless the experience of these two authorities and others would justify the operation of resection for the most malignant sarcoma, providing that the disease is still confined to the bone and the periosteum.

DR. DE FOREST WILLARD said that there was present a physician, Dr. McCollin, in the amputation of whose thigh he had assisted Dr. Agnew more than ten years ago. He had a medullary sarcoma of the lower end of the femur, so far advanced that the bone broke on slight force in getting out of bed. The amputation was made at the upper third of the thigh. He has been doing ten years of good, solid professional work since that time.

In sarcoma, fracture is not infrequent. In another case of amputation for sarcoma of the lower end of the femur he had the same accident occur as he picked up the limb to amputate. This person later had sarcoma in almost every organ of the body, even in the heart walls and in the endocardium. He was now treating a fracture of the femur produced by voluntary muscular action in a case of recurrent sarcoma, and had seen a number of such instances. In one case both humeri broke within three weeks from trivial causes.

In a case of amputation at the shoulder-joint which he performed three years ago for small round-celled sarcoma there has been no recurrence since.

DR. MCCOLLIN said that it was eleven years, the twelfth day of June, since he was operated on by Dr. Agnew. He believed that all present wanted to take off the left leg at the hip-joint except Dr. Agnew, who insisted on there being a short stump left. It had been a great comfort to him. He had been able to walk and do his work. He had not had any recurrence or pain. It healed up rapidly, and on the sixteenth day after operation he went out to see a patient.

He was exceedingly interested in the toxin treatment. It recalled to his mind a case upon which Dr. Barton operated, a young man who had a sarcoma of the abdomen. Upon making an exploratory operation, it was found impossible to remove it. The wound was closed and the young man put to bed. Great inflammation started up immediately afterwards. Six weeks after, when he got out of bed, he had no tumor, and never has had any since. That has been at least four years ago.

DR. RODMAN spoke of the only case of a successful amputation for sarcoma that he had ever known, and it was in the pre-aseptic era. He was operated in October, 1879, by the elder Gross. The wound suppurated very freely, and the man went home to Texas. Five years afterwards he was in good health.

Dr. Rodman believed that infection should be invited, and thought the same principle should be made use of in operations for tubercular glands. It is a well known fact that suppuration is more apt to cure tubercular glands permanently than excision followed by primary union. There is an antagonism between the germs of suppuration and tuberculosis, and there is far less risk to recurrence if suppuration occurs. One often sees middle-aged and old people with scars indicating scrofulous glands in childhood.

The only successful case of operation for sarcoma he had had was after excision of the lower jaw. The patient lived many years afterwards. In a second case, excision of upper jaw, eighteen months since operation have elapsed, without recurrence.

He believed that the toxins should be used in all cases after operation. He had seen betterment in many cases, but had never seen positive cure.

He had been using the toxins ever since 1893, in all of his cases of inoperable sarcoma, but has only seen temporary betterment, unless the case now under observation should prove to be the exception to a very general rule.

DR. COLEY remarked apropos of the question as to whether the early results of operations for sarcoma were better than the recent ones, and the statement that if the theory of infection held true they ought to have been better, that a very careful reading of Gross's classical article on sarcoma, published in the *American Journal*, 1879, will convince any one that those results were better than those which had been given by Dr. Wyeth. This bears out the fact that infection occurred, and in pre-antiseptic days had better effect and gave better results. There is no way of explaining these better results except on the theory of infection. As to later recurrence, he had two cases of sarcoma of the jaw, one recurring ten years after excision of the lower jaw, and another lower-jaw sarcoma occurring five years after excision of the lower jaw.

DR. ROBERT G. LE CONTE said that there was one point that had been touched on but lightly in the discussion, namely, the

degree of malignancy of the growth when compared to the age of the patient. In an experience limited to six cases of sarcoma of the extremities, he had noticed that the speed of recurrence had been directly proportional to the youth of the patient, in other words, that the most favorable forms of sarcoma are more malignant in the young than the most malignant forms are in elderly people. Dr. Coley had spoken of a chondrosarcoma of the condyle of the femur in a young girl, where, from the situation and character of the growth, he had every reason to expect a favorable result after operation, yet recurrence occurred very quickly, and death soon followed. As an antithesis to this case, Dr. Le Conte reported the history of a farmer aged forty-seven, whom he saw in March, 1898. The man had suffered severely for more than ten years with rheumatic gout, and urate of soda had been freely deposited about the finger-joints. In one finger the chalky deposit was as large as an olive, and the joints were ankylosed so that it interfered with his work. He wished to have it amputated. In examining him there was found a hard, lobulated tumor at the right femoral ring as large as an orange, which he stated had appeared about a year previously as a small nodule. The right popliteal space was also the seat of an ill-defined tumor. The later growth he had only noticed a couple of months. The growths were evidently malignant, and amputation was advised, which was refused; but Dr. Le Conte was given permission to remove the femoral tumor at the time that he amputated the finger. The femoral tumor proved to be a mass of lymphatic glands, the seat of melanotic sarcoma. Nine months later the man returned to the hospital during the service of one of his colleagues. The popliteal growth had increased to the size of two fists, and interfered very much with locomotion. There was no local return in the femoral region, nor any evidence of metastasis to internal organs. The thigh was amputated at the middle, as he positively refused a hip removal.

Six months after the amputation recurrence occurred locally in the stump and also in the abdominal wall, and he finally died in July, 1900, from internal recurrence. He therefore lived eighteen months after the amputation, twenty-seven months after the removal of the femoral glands, and thirty-seven months from the first appearance of the femoral tumor, which was surely secondary to the popliteal growth. The contrast between these two cases is certainly very great, and it makes one feel that, in

estimating the malignancy of a sarcoma, the age of the patient is of more importance than the type of cells in the tumor.

DR. WYETH said that he had learned by experience that the safety of the patient lies in the early recognition of these malignant neoplasms, and their immediate and radical removal. He approved most earnestly of the remarks of Professor Keen to the effect that they should be operated upon, no matter where the lesion may be located. It is certain death to permit a tumor to run its course.

In regard to the question of the advisability of an immediate infection of a stump after an amputation, or a secondary infection induced after all the acute inflammatory symptoms caused by the operation have subsided, he would be determined somewhat by the condition of the patient at the close of the operation. In an anæmic subject with low resistance it would be probably more dangerous and increase the mortality of the operation to infect the stump at the time of operation. Where the patient was, however, in good condition, he would prefer to infect the stump at once. Fortunately, the majority of cases of amputation at the hip for sarcoma are in excellent condition after the operation. In these he insisted upon immediate infection, for the following reasons: First, it does not materially add to the danger of death from the operation; in the second place, these patients, when they have recovered from the immediate effects of an amputation, feel so well that it is difficult to get them to return for an infection, and the tendency to recurrence is so great that it is safest for them to run the small additional risk of the streptococcus infection than the return of the disease. It may seem dangerous, and may be construed by some to be unsurgical, but this form of cruelty may be compared to that which Hamlet expressed when he said, "I must be cruel, only to be kind."

Another important point in the consideration of sarcomata is the fact that in many instances the germs of the disease have already escaped from the tumor before the operation is undertaken and have lodged in distant viscera, where they lay dormant in these secondary deposits until the conditions are favorable to their development, and then grow rapidly, as shown in the cases reported. Streptococcus infection, if it does not cure, will without doubt weaken the germs which have undergone metastasis and retard their development.

CORRESPONDENCE.

INTRAPERITONEAL RUPTURE OF THE BLADDER.

Editor ANNALS OF SURGERY.

In the March, 1894, issue of the ANNALS OF SURGERY you published a note from me calling attention to the fact that I had published in the July 28, 1888, number of the *American Medical Association Journal* a report of a successful case of intraperitoneal rupture of the bladder, together with a table of all recorded cases up to that date. This note was a comment on a table and report of a case by Dr. Kerr, of Washington, published in the December ANNALS of 1893, in which my report was overlooked by Dr. Kerr. I noted in the June ANNALS for 1896 a similar table and report of a case by Mr. George Heaton, of Birmingham, England, purporting to recite all reported cases up to that date (but not nearly doing so), in which no mention of my case was made. In the August number of the ANNALS appears a splendid recapitulation by Dr. Samuel Alexander, who, it appears, saw neither my original report nor the note to the ANNALS, though both are properly indexed in the respective journals. Inasmuch as my operation was the first successful one for the lesion done in America, and as the statistics I then reported are the same up to date as those given by Drs. Alexander, Kerr, and Heaton, I think it is not out of place that I bring this to notice through your columns.

H. HORACE GRANT.

LOUISVILLE, KY., August 17, 1901.

GENITAL TUBERCULOSIS, WITH SPECIAL REFERENCE TO THE SEMINAL VESICLES.

REPORT OF TWO CASES OF SPERMATOCYSTECTOMY.¹

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ABOUT one year ago the writer was urged to operate for the relief of a patient suffering severely from extensive tuberculosis of the posterior portion of the bladder, associated with disease of the seminal vesicles.

After stripping away the peritoneum from the posterior wall of the bladder, preparatory to excision of the disease, it was found very easy, by continuing the separation of the peritoneum, to reach the seminal vesicles, isolate them from surrounding structures, and excise them in one piece with the abdominal portion of the vasa deferentia. This case has been reported in the *ANNALS OF SURGERY* for October, 1900, where the operative details are given.

The efficiency of this "suprapubic, retrocystic, extraperitoneal" method of removing the seminal vesicles and vasa deferentia led the writer to employ this method in two cases associated with tuberculosis of the epididymis on both sides, and these cases form the basis of this report.

CASE I.¹—P. S., aged sixty-two years; German. Admitted to the Johns Hopkins Hospital, May 30, 1900.

Complaint.—Pain in testicle and lower abdomen.

Family History.—Negative.

¹ Thesis for the American Society of Genito-Urinary Surgeons, 1901.

Past History.—Has generally been very healthy, had no diseases of childhood, and was perfectly well until about ten years ago, since which time he has had a cough, with expectoration which has been yellow in color and never tinged with blood. Appetite and digestion have been poor during the last few years, and he now suffers considerably with constipation. He denies all venereal history, and says he had no urinary trouble until an attack of retention of urine two years ago, which was relieved without catheterization.

Present Illness.—The beginning of his present trouble cannot be accurately obtained. There has been some slight difficulty of urination ever since the attack of retention two years ago; but, although the urine comes slowly, he has had no pain on urination and has not had to get up at night to urinate. No history of hæmaturia.

Six months ago the patient noticed for the first time a small swelling in the left side of scrotum, which soon became as large as three fingers and quite painful. This swelling has persisted ever since. There is no history of trauma, previous urethritis, nor of pain in the region of the prostate. He has noticed no enlargement of the right scrotal contents.

Examination.—A fairly well nourished old man, pulse regular, arteries only slightly sclerotic. Thorax well formed, expansion good and equal, normal on percussion. On auscultation, a few fine râles are heard over the upper right front. Heart negative; abdomen negative; osseous system negative; glands negative.

Scrotum.—On the right side the testicle and globus major are normal, but the globus minor is much indurated and enlarged, measuring $2 \times 2\frac{1}{2} \times 3$ centimetres in size, but not tender on pressure. (The patient is not aware of the existence of any trouble here.) The vas deferens is enlarged, indurated, and contains three nodular masses, the largest, 1.5 centimetres in diameter, being at the external ring. The skin is not adherent, and there are no sinuses on this side.

On the left side the testicle, which appears normal, is almost completely surrounded by a very large swelling of the entire epididymis, which measures $3 \times 4 \times 8$ centimetres in size, and is very hard, nodular, and irregular in contour.

The vas deferens is much enlarged up to the point where it

enters the inguinal canal, and about its middle is an abscess 2×3 centimetres in size which communicates with the skin surface by a small fistula. The penis is normal in appearance. There is no urethral discharge.

Rectal Examination.—The rectal mucosa is smooth, soft, and not adherent to the deeper structures. The prostate is a little broader than normal. Its surface is smooth, a little firmer than normal, but not nodular. Just above and confluent with the upper end of each lateral lobe of the prostate is an elongated, hard,

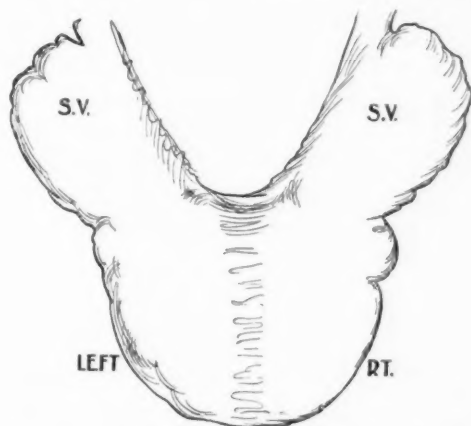


FIG. 1.—Drawing showing appearance of prostate and enlarged adherent vesicles on rectal examination.

nodular mass, about 1.5 centimetres broad. At their junction with the prostate these masses are about a finger's-breadth apart. Their upper limits cannot be reached by the palpating finger. No distinction can be made between the vas and vesicle, and the upper end of the prostatic lobes are closely adherent and involved in the induration for a short distance (Fig. 1).

Cystoscopic Examination.—Rubber catheter entered easily, withdrawing a small amount of clear urine. A Nitze cystoscope failed to show any vesical lesion. The mucosa was normal in appearance, and there was no intravesical prostatic enlargement. The right ureteral orifice was a little redder than normal, but not ulcerative.

Urinary Analysis (before examination with instruments).—Acid, slightly cloudy, yellow, 1021, no sugar, a trace of albumen.

Microscopical examination, a few epithelial cells and leucocytes, amorphous salts, mucus.

The three-glass test shows a slight cloud in each glass, which, with the microscope, is found to be composed of epithelial cells and leucocytes. No bacteria present; a careful search made for tubercle bacilli.

Remarks.—We had then to deal with an extensive tuberculous disease of both the epididymis, vasa deferentia, and seminal vesicles. The bladder and prostate seemed free from disease, though the upper part of the prostate was closely adherent to the diseased vesicles. The urinary examination indicated healthy kidneys, and a few râles heard in the upper portion of the right lung were considered insignificant.

Complete excision of the tract involved was deemed necessary for a cure, and, on account of the bilateral character of the disease, the suprapubic extraperitoneal excision of the vesicles and vasa seemed preferable to Roux's method. The details of the operation are as follows:

Operation, June 9, 1900.—Ether anæsthesia. Transverse incision through the recti muscles, just above the umbilicus, in the linea transversa. (See Figs. 5 and 6.) Separation of the peritoneum from the vertex of the bladder. Catheterization of the two ureters. Further separation of peritoneum from posterior wall of bladder in median line until the vasa deferentia were encountered. Isolation of vasa deferentia and seminal vesicles. Incision through upper half of prostate (behind the urethra, thus freeing the vesicles with a portion of the prostate attached). Division of the vasa at the external rings and excision of the testicles and remainder of the vasa deferentia. Excision of a small tuberculous ulcer of posterior wall of bladder. Complete closure of bladder. Suture of divided recti muscles, and almost complete closure of the median incision. Gauze drainage into space around bladder. Catheter left in urethra. Intravenous transfusion of 1700 cubic centimetres salt solution.

Remarks on Operation.—The transverse division of the recti muscles above the umbilicus was done to secure more room, and in preference to the lower division of these muscles which we have found impossible to close by sutures. This plan succeeded admirably, and will be discussed more at length later on.

It was found quite easy to strip the peritoneum from the

posterior wall of the bladder; the principal difficulty being at the vertex, where the urachus comes off from the bladder. On opening the bladder, a small, elevated, gray mass of exudate was found on the posterior wall. Smears from this showed tubercle bacilli. The lesion was therefore excised with an elliptical piece of bladder wall surrounding it and the wound closed retrovesically. The rest of the bladder was perfectly healthy. The ureters were catheterized so as not to run the risk of dividing them in the removal of the vesicles; but this is now considered unnecessary by the writer. There was a little difficulty in freeing the seminal vesicles and vasa deferentia from adhesions to surrounding structures; but it was accomplished by means of blunt dissection with instruments, index-fingers, and scissors, without tearing into the diseased parts. The prostate was also separated from the surrounding tissues, and a considerable portion of it was cut off with a knife and removed along with the vesicles and vasa. Much more could have been removed if desired.

The vasa deferentia which had been isolated as far as the internal ring (a procedure which has since been found unnecessary) were easily removed after a division of the spermatic cords at the external rings, the tract being then removed in three pieces, as shown by the photograph of specimen (Fig. 2). In this case the testicles were removed through two inguinal incisions; but in the later operation (*q. v.*) it has been found perfectly feasible to remove them through the median abdominal incision by simply elevating the skin from the rectus muscle on each side at the symphysis.

The time of operation was two hours and a quarter, the amount of blood lost small, and the condition of the patient good throughout. An intravenous infusion was given as a prophylactic against shock. During the night after the operation, the patient, though perfectly rational, got out of bed and removed the catheter from his urethra; as several hours had elapsed before he was seen by the ward surgeon and as the patient had voided naturally several times, the catheter was not replaced. This proved to be a mistake, as the bladder sutures subsequently allowed an escape of urine.

Pathological Report on Specimens removed.—Right testicle is surrounded by a small hydrocele. Globus minor of epididymis

replaced by a caseous tuberculous mass two centimetres in diameter. The lower end of the testis is involved in the tuberculous process. The vas deferens contains several caseous nodules.

The left testicle: Both ends of epididymis contain tuberculous abscesses, but the testis is not involved. The tunica vaginalis is much thickened, and in places adherent to the testis. A small hydrocele is present. The vas deferens is much enlarged, and at a point five centimetres above the testicle it is involved in a small caseous abscess.

The seminal vesicles have been removed in one piece with the abdominal portion of the vasa deferentia (about sixteen centimetres long) and a portion of the prostate five centimetres long and two centimetres thick. The vesicles are transformed into hard, oval masses about two centimetres in diameter, and are closely adherent to the vasa, and also to the upper end of the prostate. Both vesicles contain caseous material. The excised portion of the right lobe of the prostate appears healthy; the course of the ejaculatory duct cannot be traced. In the excised portion of the left lobe there is a small caseous nodule by the side of the ejaculatory duct; the prostatic tissue below this is healthy. Both vasa deferentia contain numerous nodules. An elliptical piece of bladder 2×3 centimetres in size has been excised; in its centre is a small ulcer eight millimetres in diameter filled with caseous material, which stands out from the surface of the bladder and makes it appear like a nodule. Tubercle bacilli are present in large numbers.

Course subsequent to Operation.—During the first five days the patient was seen by operator, and was in good condition. He had himself removed the urethral catheter during the night after operation, and since then had voided without trouble. There was no leakage of urine through the abdominal wound at that date. On the fourth day he became jaundiced; this soon increased markedly, and he became very constipated. A cough which had been present became much aggravated, and the patient persistently refused to take nourishment. Temperature remained about normal and the pulse between 90 and 100.

Urine began to leak through the bladder suture about ten days after operation.

Two weeks after operation he was very restless, sleepless, deeply jaundiced, coughing much, and refusing nourishment.

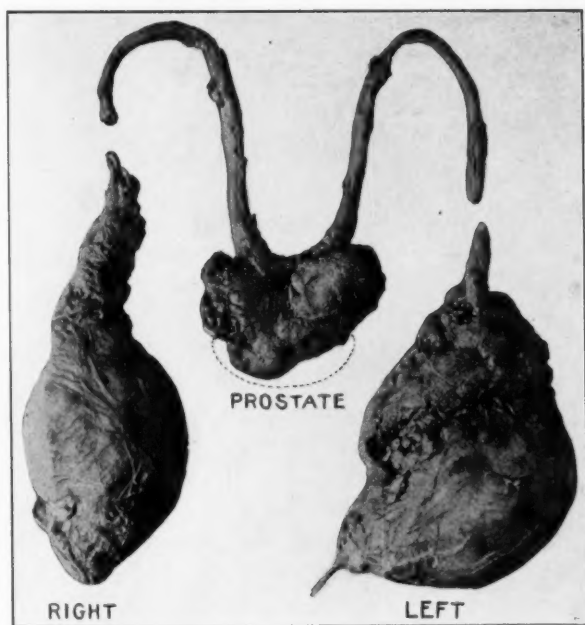


FIG. 2.—Showing seminal vesicles and portion of the vasa deferentia.

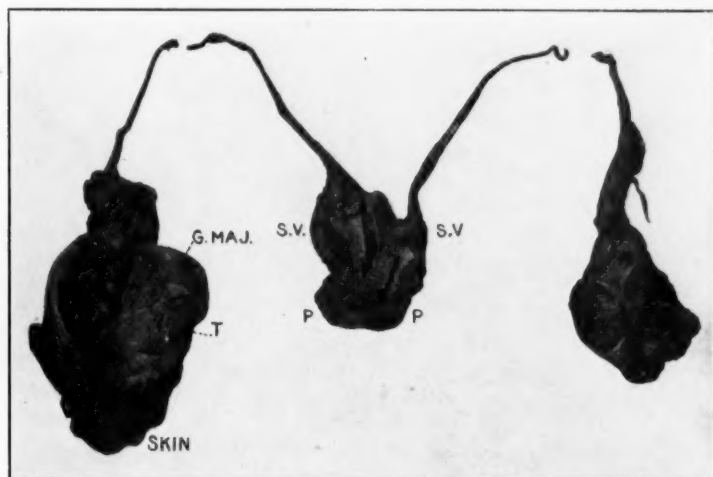
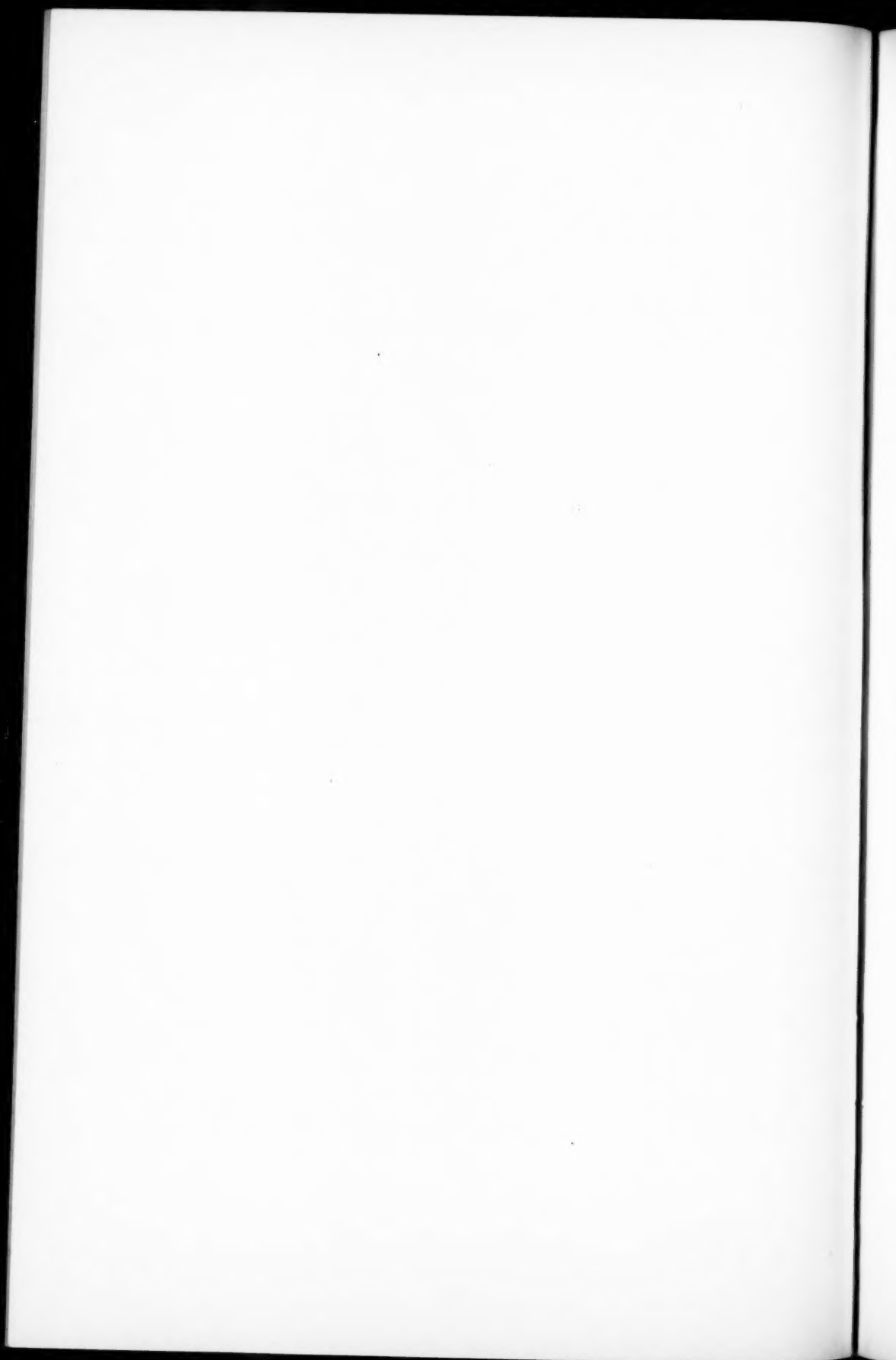


FIG. 4.—The two seminal vesicles removed with the adjacent prostate.



The local operative conditions were good. Temperature, 98.4° F.; pulse, 120.

On the eighteenth day he died of exhaustion. There was nothing sufficient to account for death in region of the bladder. Autopsy showed old pleuritic adhesions and an abscess in the left lung. In the left lobe of the prostate were several small caseous nodules; the right lobe was healthy.

CASE II.—J. C., aged thirty years; negro. Admitted to the Johns Hopkins Hospital Dispensary, February 14, 1901.

Complaint.—Swollen testicle.

Family History.—Negative.

Past History.—Healthy as a child; had mumps, but no orchitis. Denies any venereal sore. Gonorrhœa three times. First attack eight years ago; duration of discharge three weeks; slight pain referred to glans on micturition, no other symptoms, no sexual disturbance. Second attack three years ago. This was more severe, and lasted about three months, accompanied by severe burning and great frequency, some tenesmus, no blood, frequent erections, chordee and nocturnal emissions, the last being slightly painful and occasionally showing blood. The treatment was by internal medication and urethral injections. From the clearing up of this attack patient noticed nothing until two years ago, when, without any urinary trouble that he could discover, his left testicle began to swell, and in about one week became very tender.

He had at that time no pain on micturition, some pain in back, but no loss of sexual power or desire. He then went to the Hopkins Dispensary, where an examination of the very slight serous discharge squeezed out from the meatus showed microscopically mostly epithelial cells, a few leucocytes but no organisms. The urine was quite cloudy in both glasses. This showed leucocytes and epithelial cells, but no bacteria. The left epididymis was indurated, enlarged to about the size of a hen's egg, very slightly painful on pressure. No sinus was present.

Three weeks later the swelling ruptured, thick yellow pus escaping. A small sinus persisted after this, and for six months continued to discharge pus.

One year ago he noticed that the testicle was again swelling and becoming more tender. After a few days, the sinus discharged pus again, with great relief from the considerable pain

which was present. Just after this he again went to the Johns Hopkins Hospital, complaining of slight burning on micturition and a slight urethral discharge. He was given some medicine which he says relieved him. No trouble from then until now, except hardness of testicle.

Present Illness.—The patient had an attack of la grippe ten days ago, at which time the right testicle began to swell and pain very severely. The swelling gradually increased and with it the pain. Twenty-four hours ago the abscess broke, letting out a

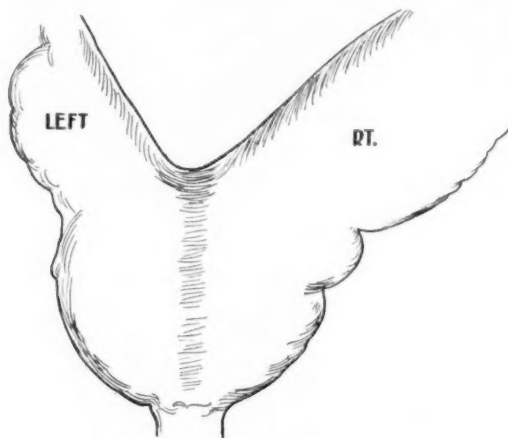


FIG. 3.—Appearance on rectal examination.

great quantity of thick pus. With this last condition there has been no urinary symptom present.

Examination.—Patient is rather thin and anæmic; eyeballs sunken. Pulse fairly strong; heart negative; lungs negative; abdomen negative; kidneys not palpable nor tender.

Genitalia.—At the lower portion of the scrotum on the left side is a sinus which leads up to the globus minor, which is enlarged and indurated. The globus major is nodular and slightly enlarged. The vas deferens is indurated and contains one large nodule. On the right side the testicle and epididymis together form a mass three or four times as large as normal, and much indurated and nodular. The entire epididymis is involved, as is also the testicle, but less so than the epididymis. The skin is adherent over the lower portion of the globus minor, which is

here softened and gives a feeling of fluctuation. The cord is distinctly enlarged and indurated.

Urine.—Three-glass test shows very cloudy urine in all glasses. Reaction acid; microscope shows great abundance of pus cells, no red blood-corpuscles, no bacteria.

After frequent irrigations of the bladder without a catheter the fluid still comes away cloudy, but as soon as a catheter is introduced into the bladder the second irrigation comes away clear (deduction: pus coming from prostate).

Cystoscopic Examination.—Irregular areas of hyperæmia and some small confluent patches of exudate on the mucous membrane external to the left ureteral orifice. These are dull gray in color, and are surrounded by a hyperæmic mucous membrane. No definite ulcerations. Ureteral orifices normal.

At the urethral orifice swelling and congestion of the median portion of the prostate and a small area covered by an exudate are seen.

Rectal Examination shows a very marked enlargement of the right seminal vesicle, which is closely adherent to the upper end of the right lobe of the prostate, which is also indurated in this portion. The left vesicle is very hard, but not nearly as large as the right; and the prostate, although adherent to the vesicle, is not indurated at its upper end (Fig. 3).

Operation, March 2, 1901.—Removal of both testicles, vasa deferentia, both seminal vesicles, and a considerable portion of the upper part of both lobes of the prostate, through a median abdominal incision.

Ether anæsthesia; condition of patient during entire operation good.

The abdominal incision used in the previous case was also employed here, the transverse incision through the recti muscles being about one-half inch above the umbilicus and three inches long. The median incision extended from this point down to the root of the penis, both incisions dividing the fascia posterior to the recti muscles, but not the peritoneum.

The peritoneum having been pushed back as far as possible from the anterior surface of the bladder, the latter was opened. A finger was then introduced and the separation of the peritoneum from the posterior wall in the middle line begun. Some difficulty was again experienced in the region of the urachus, but

as soon as this point was passed the peritoneum was easily stripped from the bladder.

In this case, the separation of peritoneum was confined to as small an area as possible in the median line (about two fingers'-breadths broad), thus disturbing none of the posterolateral blood supply of the bladder, and also avoiding the chance of injuring the ureters.

The bladder was opened on account of a desire to cauterize the diseased area which had been seen through the cystoscope. This area was found to consist of a small patch of exudate lying external to the left ureteral orifice. Pure carbolic acid was applied. No ulcers were found and the rest of the bladder was healthy. From the ureteral opening a large stream of pus was seen flowing back into the bladder. This was afterwards found to come from the left seminal vesicle, which communicated directly with the prostatic urethra by an opening one centimetre in diameter.

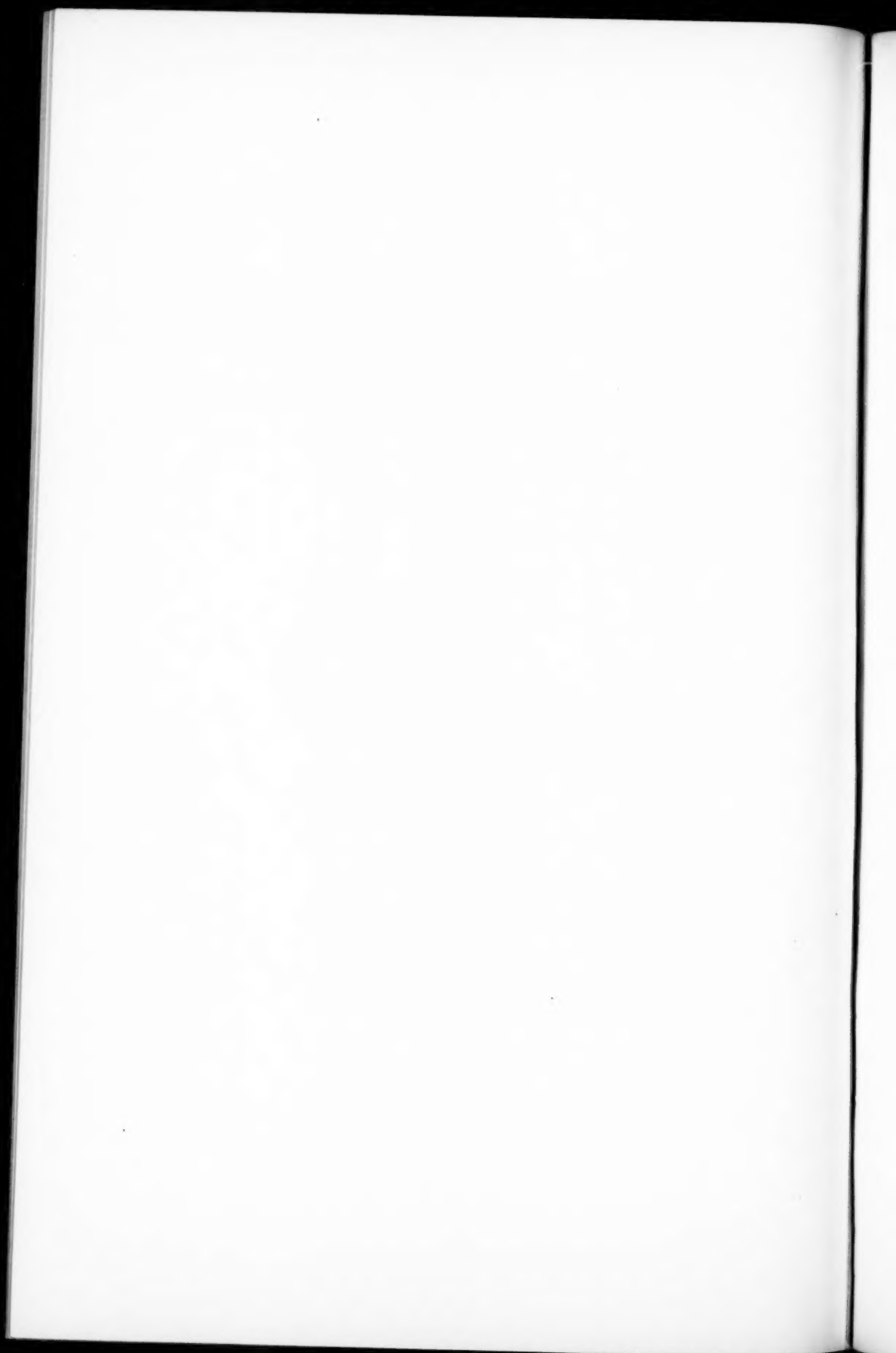
As the bladder had been opened, catheters were inserted into the ureters, though this is unnecessary.

The isolation of the seminal vesicles and adjacent vasa was easily accomplished, mostly by blunt dissection; the posterior surface of the prostate being also freed from the rectum. The right seminal vesicle was very much enlarged, indurated, and closely bound down to the upper end of the right lobe of the prostate. The left seminal vesicle was very hard, but rather contracted. A considerable portion of the prostate was removed in one piece with the seminal vesicles, by an incision which began at the top of the prostate, in front of its junction with the seminal vesicles, and, running obliquely behind the urethra, ended about the middle of the posterior surface of the prostate. An examination showed that the right lobe at the point of division was healthy, but that in the left lobe there was a necrotic fistula opening directly into the urethra. On palpation, however, the rest of the prostate seemed to be healthy. The edges of the fistula were, therefore, excised and the opening closed by drawing over it healthy prostatic tissue, two silk sutures being used.

The testicles were removed through the abdominal incision. This was easily accomplished by elevating the skin from the recti at their lower insertions, and thus exposing the spermatic cords. Traction on these drew the testicles out of the scrotum



FIG. 5.—Showing Case II four weeks after operation, showing T incision through which testicles, vasa, and vesicles were removed. Suprapubic sinus is still open.



into the wound. After ligation and division of the spermatic blood-vessels, the vas deferens on either side was loosened in its course along the canal and around the bladder by alternate traction upon the isolated mass of vesicles internally and the testicles externally. The vasa, having been ligated and divided at the external rings and their ends touched with pure carbolic acid, were drawn through the canal from within, the entire tract being thus removed in three pieces, as shown in Fig. 4.

Closure of Wound.—The divided recti were approximated by four mattress silver-wire sutures. The median incision was likewise closed to within two inches of the symphysis. A drainage tube was placed into the retrovesical space, the bladder was closed tightly with catgut around a large rubber tube, and a few wicks of iodoform gauze were placed in the perivesical space. A small wound in the scrotum, which was made in excising the sinus present, was partially closed with silk.

Pathological Report.—Specimen consists of both testicles, vasa deferentia, seminal vesicles, and part of the prostate, all in three pieces.

The left testicle is soft and atrophic. The head of the epididymis is thickened, nodular, indurated. The globus minor contains a small caseous mass and the adjacent vas has also caseous areas.

The right testicle is much enlarged, and on section numerous small caseous areas. The whole epididymis is tuberculous. A portion of skin of scrotum surrounding a sinus leading into the epididymis is present. The vas deferens is also involved in the disease.

The two seminal vesicles have been removed with the adjacent prostate, as shown in Fig. 4. The left vesicle is small, very hard and irregular, contains caseous material, which continues through the prostatic tissue of that side as a large necrotic sinus. The prostate surrounding the sinus is sclerotic. The right vesicle is very much larger, and also contains large communicating caseous areas. The prostate on this side shows small areas of focal necrosis. The vasa deferentia are closely bound to the adjacent vesicles and these to each other.

The photograph shows the organs after incision for pathological study (Fig. 4).

Convalescence.—Patient reacted well from operation. Pulse

ranged between 100 and 108 during the following night. On the third day there was nausea, with slight vomiting and considerable tympanitis, relieved by enemata. Subsequent convalescence uneventful except for the presence of an evening pyrexia between 101° and 102° F.

The vesical drainage through rubber tube acted well; leakage around it slight. The drain was removed from the space

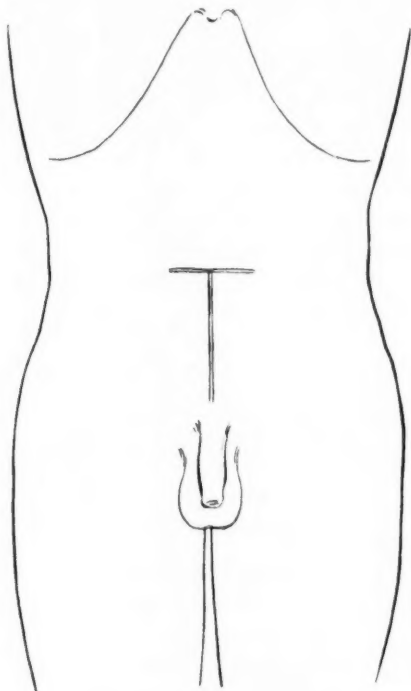


FIG. 6.—T incision.

behind bladder on the third day. On the ninth day a superficial periurethral abscess developed in the perineum, which was incised. No apparent connection with pelvic operation.

Examination four weeks after operation. Small fistula in lower part of suprapubic wound which leads into the bladder and also into a sinus behind the bladder. The incised wound of perineum (abscess) is healing slowly. Rectal examination negative. Urine is very cloudy, purulent, and patient continues

to have pyrexia at night. Patient is up and about, appetite good. The scrotal and higher abdominal wounds have healed solidly.¹

TUBERCULOSIS OF THE GENITAL TRACT.

During the year 1899 this question occupied the entire attention of the Société de Chirurgie of Paris² at its weekly meetings for nearly six months, eliciting a very spirited and comprehensive discussion, but the more important questions are still unsettled.

This is principally due to the fact that few accurate statistics of clinical examinations, pathological investigations, and cases followed for a sufficiently long period of time have been brought forward.

We will take up briefly the more important questions.

(A) *The Question of Primary Involvement.*—This question is one of vital importance to the surgeon, for if the disease in the testicle is merely a local manifestation of more or less generalized tuberculosis, radical measures are at once contra-indicated; and if it is secondary to disease of the seminal vesicles or prostate, nothing short of operation upon these organs would seem to promise radical results. There are still those who claim that testicular tuberculosis is always preceded by foci of disease in the lungs, pleura, mediastinal glands, etc., and that the bacilli reach the scrotum by the blood-vessels or by the lymphatics.

That the disease may come through the mediastinal glands is not at all improbable, as Bugge has found that about 75 per cent. of persons dying from all causes show tuberculosis of the mediastinal glands.

It is true that autopsy records of patients dying with genital tuberculosis show lung involvement in a majority of cases (Villard, in 70 per cent. of 176 cases). But, as Reynier has shown, these statistics are of little value, as autopsies are seldom performed early in the disease.

¹ July, 1901. Patient died with symptoms of miliary tuberculosis, and autopsy showed a completely generalized tuberculosis, with extensive disease about the bladder.

Cayla, Lecorche, Cohnheim, Barette, Brissaud, and Steinthal believe that it is primary in the urinary apparatus, and secondary in the genital. After a careful study of 222 cases and forty-two autopsies, Guyon³ concluded that there existed a primary urinary tuberculosis as well as a primary genital, but that the genital is the more common, that the disease most often ascends from the genital tract to the urinary, and autopsies show that the disease has always passed beyond the purely genital tract. As long as the disease remains purely genital there is little danger of death, but as soon as it begins to ascend into the urinary tract there is much to be feared.

Lancereaux⁴ came to the conclusion that genital tuberculosis is always of a descending nature, the primary focus being in the prostate or seminal vesicles.

Monod and Terillon⁵ hold that it is rare to find, by clinical or pathological examination, tuberculosis of the testicle unaccompanied by tuberculosis of the prostate, the development primarily being in the prostate or vesicles. Weigert says the prostate is a "place of predilection" for bacillary localization of every kind.

Guyon³ considers disease of the prostate the predecessor of all cases of so-called bladder tuberculosis. König,⁶ in his study of forty-five cases (abstracted in detail farther on in this paper, Section E), found the prostate and vesicles uninvolved in fourteen cases. In the other thirty-one cases, where the prostate was diseased, both testicles were involved in fourteen cases. In the fourteen cases, where the prostate or vesicles were free from disease, in only three of these was the testicular disease bilateral. König reports no case of tuberculosis of the prostate or seminal vesicles without disease of the testicle; but in the face of these statistics he upholds the view of his patron Kocher, that primary testicular tuberculosis is the exception, and that even in these apparent cases the primary focus of infection is probably an unperceived disease of the prostate.

It is certainly a fact that most cases of testicular tu-

berculosis show at the first examination involvement of the higher organs, but it is also true that such cases are rarely seen early.

Reynier² has recently taken a strong stand in favor of primary involvement of the epididymis, claiming that early examination will demonstrate this fact, and bringing forward the following cases in support of his position. A patient dying from fracture of the skull showed at autopsy early tuberculosis of the epididymis and no other localization. Three cases of early tuberculosis of the epididymis showed after careful clinical examination no lesions of the prostate or vesicles. In two cases in which he performed castration on one side for disease apparently localized there, examinations six and seven years after show still no lesion of the prostate.

Tillaux had a similar case of early tuberculous epididymitis, with no other lesion discoverable, and cured by vasectomy.

The numerous cases giving a history of injury to the testicle immediately preceding the tuberculous enlargement are also offered as evidence of primary localizations in epididymitis. In a review of the vesiculectomy cases, of which a tabulation is here appended, one is struck with the very great frequency with which a gonorrhœal epididymitis preceded the tuberculous disease.

After a careful study of the literature, Dimitresco,⁷ in 1897, came to the following conclusions:

"The disease may begin primarily in the prostate, seminal vesicles, or epididymis; the latter being the method in an immense majority of cases. The testicle is always healthy at first, except in rare instances."

In children, however, the testicle is much more frequently involved.

In one of my cases, here reported, the tuberculous involvement of epididymis followed one year after a gonorrhœal epididymitis, and I have observed other similar cases. It therefore seems to me sufficiently proven that primary tuberculosis of the epididymis occurs, and probably is the most common

initial lesion; though it cannot be denied that involvement of the epididymis secondarily to disease of the seminal vesicles and prostate often occurs, as it does less frequently after tuberculosis of the lungs and of the urinary tract.

As to the exact point of primary localization, it is quite generally held to occur most often in the globus major, less frequently in the globus minor, and never in the testicle, except as a secondary invasion from the epididymis or the tunica vaginalis. Murphy, however, is of the opinion that the primary focus in an adult is in the globus minor. Recent French writers have laid great stress upon the immunity of the testis, even late in the disease.

(B) *Course of the Disease.*—After the primary localization in the epididymis, the progress of the disease may be very variable, depending apparently on the virulence of the process. As pointed out by Tuffier² a tuberculous testicle may remain the same for fifteen years, while in other cases there may be a very rapid spread of the disease along the seminal tract. The testicle proper is rarely involved except late. At times the disease remains local and may cure itself by caseation, fistulization, and cicatrization; but again it may travel rapidly upward, involving the vas, vesicle, prostate, other testicle, and ultimately the urinary tract.

Potherat² holds that there may be foci in the prostate when nothing abnormal can be felt by rectal touch; but he believes there is generally present a discharge from the posterior urethra, a preliminary prostatorrhœa, which should make us suspicious.

Beurnier² reports a case where on rectal examination nothing was found in the vesicles or vas, and where the vas removed by the inguinal method to within a short distance of the seminal vesicle looked perfectly healthy, but on microscopic examination showed tuberculous foci.

The great frequency with which the second testicle becomes involved after a previous castration on the other side, which seemed to remove the entire disease, is another illustra-

tion of our inability to determine clinically the exact limits of the disease.

A careful microscopic examination of the fluid obtained from the prostate, seminal vesicles, and ampullæ of the vasa—a method which Weir alone seems to have made use of—should give us a more accurate determination of these deeper lesions.

The French writers who have furnished a large part of the literature on genital tuberculosis have paid little attention to the distinction between prostate and seminal vesicles, generally ignoring the latter in their descriptions, and leading one to believe that lesions of the prostate were the more prominent. This, however, is distinctly disproven by autopsy findings and the published reports of the operations for removal of the seminal vesicles. In the thirty-four vesiculectomies which I have collected from the literature, in only five did the operator find disease of the prostate, and then it involved, as a rule, the upper portion of a lobe adjacent to the vesicle or ejaculatory duct.

In my first case there were several small caseous nodules in the prostate along the course of the ejaculatory duct; and in my second this duct was transformed into a large necrotic fistula leading from the seminal vesicle to the prostate, which had other small focal areas of caseation.

In nineteen cases of tuberculosis of the prostate collected by Hogge,⁸ only one case (Dittel's) in which the disease was primary in the prostate, and probably did not involve the seminal vesicles, is found. It has been shown that while the tuberculous infection travels up from the testicle, the middle portion of the vas often escapes infection, locating, by preference, at its upper end (ampulla). Pathological examinations seem to show that the ejaculatory duct and neighboring vesicle are next involved, and then that portion of the prostate adjacent to the ejaculatory duct, from whence the urethra and bladder become infected.

Numerous cases are at hand to show that the pus from the prostate may continue to flow back and collect in the bladder for a long time without infecting that viscus.

(C) *The Effect of Castration on the Tuberculous Prostate.*

—The remarkable effects of castration and vasectomy on the hypertrophied prostate have recently been claimed to have a more wonderful counterpart in the effect of these operations upon tuberculosis of the prostate and seminal vesicles.

In the Société de Chirurgie² numerous observations were reported showing a complete disappearance of prostatic and urinary symptoms after castration or epididymectomy.

Reynier says that the lesions in the prostate seem to depend in severity upon the lesions of the epididymis; when the lesion of the epididymis improves, the lesions of the prostate improve. He adduced two cases of double testicular tuberculosis with prostatic involvement which were cured by removal of the testicular disease (examinations six and two years later).

Bazy reported a case where a tuberculous nodule in the prostate the size of a cherry became very small, hard, and firm after bilateral castration, with complete cure of the disease (examination two years after operation).

Poirier detailed a case of bilateral tuberculosis of the epididymis, with involvement of the prostate and seminal vesicles, in which the entire disease was completely cured by destruction of the testicular foci (examination one year later showed prostate normal).

The same results are shown among the cases collected in their theses (Paris) by Euvrard (1894), Chevrolle and Dimi-tresco (1897).

Murphy⁹ reports four cases carefully followed after periods ranging from one and a half to five years after the last operation (Cases II, IV, V, VIII). In every case the disease was bilateral, involving both epididymis, and in three of the cases urinary symptoms were present (dysuria, increased frequency, pus and blood).

Examinations, made respectively four, four, four, and one and a half years after the last operation (epididymectomy), showed a perfect cure of the disease. A remarkable feature in all these cases was the rapidity with which the urinary dis-

turbance was ameliorated and cured. In one case, in which the patient was obliged to urinate every twenty minutes, there was almost immediate disappearance of all subjective urinary disturbance after unilateral castration. Unfortunately, in none of these cases is there any record of rectal examinations made before the operation, so that we cannot be sure that tuberculosis of the prostatic region was present.

Murphy himself says, "That the vesical irritation and hæmorrhage are not always manifestations of a tubercular process in the bladder and prostate, we are convinced from clinical observation, as in almost all cases in which these symptoms are present there is an immediate cessation of them after castration or resection of the epididymis, which could not possibly be the case if the disease were tuberculous."

Reclus,² however, expresses the opinion that the vast majority of cases of tuberculosis of the testicle is accompanied by foci in the prostate and vesicles, and "yet the patients get well after castration."

Delbet² says that some cases of prostatic and vesicular tuberculosis do progress after epididymectomy, but that these are rare. He thinks the reason for the amelioration of the prostatic and urinary symptoms is that the constant stream of virulent products from the diseased epididymis is stopped, and the irritation of the prostate and adjacent structures ceases. According to Murphy, this discharge produces a catarrhal condition of the mucous membrane in the posterior urethra and trigone of the bladder, with in many cases erosions and superficial ulcerations.

The well-known atrophic effect of vasectomy upon the prostate may play some part in these supposed cures, but probably only when the operation is double.

The most convincing statistics are those of König,⁶ reported in full later (Section E). In forty-five carefully examined cases, the prostate or vesicles were involved in thirty-one,—seventeen times with disease of one testicle and fourteen times of both testicles present. Of the seventeen cases accompanied by tuberculosis of one testicle, fourteen were followed

over two years with ten complete cures, one improvement, and one death.

Of the fourteen cases exhibiting double testicular disease, nine were cured, two improved, and two died. All of these fatal cases had involvement of the lungs or urinary tract before the operation (as did also several of the cured cases, the castration being followed by a disappearance also of the distant disease).

It is therefore well established that tuberculosis of the prostate and vesicles not only does not contraindicate operation, but in the majority of instances will disappear after the operation. This seems to follow the partial operation (epididymectomy, etc.) as well as castration.

(D) *The so-called Internal Secretion of the Testis.*—Recent literature has been very full of the question of an internal secretion and the "moral effect" of castration. After a careful study of the literature, Dimitresco⁷ brings forward the following conclusions:

(1) Teratology furnishes certain proof of the double rôle of the testicle, that of a vascular gland and that of a gland of excretion; for, in spite of congenital absence of the vas deferens, of one or both sides, the man not only shows a full development of the testes, continuing to secrete spermatozoa, but also sexual potency, though of course sterile. (See autopsy findings of Tenon, Brugnogne, Hunter, Gosselin, Simon, and Godard.)

(2) Experiments on animals, performed first by Astley Cooper in 1823 and repeated since by Curling, Gosselin, White, and others, show that after excision of the vas deferens the testicles retain their normal size and consistence, while all purely excretory glands atrophy after ligation of their ducts. The testis should therefore be classed with the ductless glands, which furnish the internal secretions so necessary for the body economy.

(3) Epididymitis leading to cicatricial destruction of the epididymis does not lead to atrophy of the testicles or diminution of the sexual power or appetite.

(4) After complete resection of the epididymis, as shown by Bardenheuer¹⁰ in thirty-four cases of double epididymectomy, the testicles remain normal in size and consistence, and microscopic examination shows the tubules normal and spermatozoa present (after two years, English).

(5) "One sees occasionally cases where after castration the power of coitus is preserved; but they are very rare exceptions. Not only is this faculty suppressed, but also profound physical and moral changes are produced."

Bardenheuer, Bazy, Routier, Quénu, Delbet, Murphy, and others have advocated the preservation of the testicles on the ground of their distinct use to the organic equilibrium and the extremely demoralizing effect of their removal. But, on the other hand, some of the German writers (Kocher) do not find such grave changes following castration.

Numerous clinical experiences are on record showing that removal of the epididymis and vasa produces no such effects; that the only power lost is that of fecundation (Bardenheuer, Dimitresco, and others), and that the curative effect is as radical as total castration.

(E) *Operative Methods and Indications.*—We have not space to more than mention some of the more popular methods of treatment which have been proposed.

The various procedures that have been advocated may be grouped as follows:

- (1) General hygienic treatment.
- (2) Local, non-operative treatment; caustics, cauterization, intranodular injections, simple incision, curettage, resection of the epididymis (Bardenheuer), castration.
- (3) High resection of the vas deferens (von Büngner, Villeneuve).
- (4) Excision of the seminal vesicle (Ullmann, Roux, and others).
- (5) Excision of prostate, partial or total (Doyen), with vesicles.

Minor modifications in treatment and operative detail,

each encumbered with the name of some surgeon, are to be found without number.

The Operative Indications may best be studied according to the pathological conditions and extent of the disease, viz.:

(a) *Simple Tuberculosis of Epididymis well Localized.*—

The greatest divergence of opinion exists as to the proper treatment to pursue.

At the clinics of Bruns and Kocher the radical operation is almost always done. Dürr, reporting investigations from Bruns's clinic, claims that the partial operation in testicular tuberculosis in adults is always to be condemned. König⁶ reports a case of recurrence in the testicle after epididymectomy, and a case dying one year later with tuberculosis of the kidney which was not present when the partial operation was done. But in this case the prostate was extensively diseased, and may be responsible for the generalization of the disease.

The report of Dimitresco's twenty-six cases is a convincing argument in favor of the efficacy of epididymectomy. Of the twenty-six cases, thirteen were carefully followed for periods ranging from one to nine years, and among these there were eleven perfect cures, local and general, after epididymectomy, unilateral in seven cases and bilateral in four cases. Only one case showed a local recurrence. In these thirteen cases no general postoperative dissemination of the disease occurred, and in only one did the disease recur in the remaining testis; and yet in many cases the epididymis was extensively diseased and often suppurative.

Bardenheuer says that only once in thirty-eight cases were the kidneys affected after the operation of epididymectomy. We have then the following fairly well established facts to help to settle this question. These are briefly:

That at an early stage the disease is generally confined to the epididymis; that the testicle is rarely involved; that the testicle is of value, although the perviousness of the seminal canal is destroyed; that epididymectomy is as effective and as free from recurrence as castration; that after both operations the opposite organ becomes affected in a large number

of cases, and double castration is much more deleterious in its effects on the sexual powers and nervous equilibrium than double epididymectomy.

Granting, then, that these propositions are pretty generally true, there is little doubt but that epididymectomy is preferable to castration. The operation of epididymectomy, as done by Bardenheuer, consists in a "subserous dissection" of the globus minor and body of the epididymis; but when the globus major is reached, the tunica vaginalis is opened and the head of the epididymis separated from the testis. This gives a good opportunity to look for tuberculosis of the tunica and testicle. The tunica vaginalis is then closed by sutures.

As for the other methods (curettage, cautery, caustics, etc.), they require a much longer time to heal, are more liable to lead to fistulæ, and may be dismissed as unsurgical.

The treatment appropriate for the vas deferens in these cases is still an unsettled question. The well-nigh universal practice is to remove the portion adjacent to the disease, or as high as the external ring, but the great frequency with which the second testicle becomes diseased after unilateral resection shows the incompleteness of these ordinary methods.

The procedure promulgated by von Büngner¹¹ (incision in groin, and traction on the vas deferens until it breaks somewhere along its course) has shown conclusively that four-fifths or more of the vas can be thus removed. Various operators have found that between twenty-five and thirty centimetres can be extracted by this method without cutting into the inguinal canal, and pathological examinations have shown the deeper portions of the extracted vas to be diseased in many cases, where nothing could be felt per rectum. The question which presents itself is this, Is this blind forcible avulsion of the vas deferens free from danger?

In a recent report, Lauenstein¹² makes a careful report of twelve cases upon which he has used von Büngner's method. In three cases considerable bleeding came from the rupture of the vas deferens; in one case forming a large postvesical blood-clot, which filled the space between the bladder and rectum,

and even extended around the bladder, beneath the abdominal wall, into the inguinal canal. This accumulation was so great as to cause temporary obliteration of the ureters. In the two other cases the extravasation of blood was less abundant. Helferich had a similar experience after von Büngner's operation, and found at autopsy (death from pyonephrosis) a blood-clot as large as a walnut in the region of the seminal vesicle.

These results, occurring so often in a small number of cases, would seem to furnish sufficient evidence for the condemnation of von Büngner's operation of forcible avulsion of the vas deferens.¹

The deep inguinal operation proposed by Villeneuve,¹³ by which alone the vas can be visually followed in its course around the bladder and ureter, is a much safer operation, and would seem to be advisable even in the simplest cases, in view of the facts set forth above. Villeneuve at first practised only a deep resection of the vas, but later extended the operation to include the seminal vesicle. Since then four vesiculectomies have been successfully performed by this method; but in two other cases the operators (Bolton, Finney) had to relinquish the effort and remove the vesicles by a perineal route.

The procedure of following the vas as far as the ureter, however, is not a very difficult procedure, and in our opinion should be done even in the apparently simple cases. But it does not seem advisable, in view of the magnitude of the operation, to extend the resection to the seminal vesicle in these simple cases, either by the inguinal or one of the perineal methods.

Opposed to this radical view are the many reported cures after simple castration, without high resection of the vas; but the frequent involvement of the other testicle after unilateral castration is alone a sufficient indication for the removal of as much of the vas deferens as can be readily done through a slightly enlarged hernial incision.

¹ Dr. Weir tells me, however, that he has made use of von Büngner's procedure in a number of cases with no bad result, and that he considers the method safe and certainly indicated along with castration.

Berger² has already advocated that castration should always be accompanied by extirpation of as much of the vas deferens as possible by the inguinal region, and reports a case where rectal examination revealed nothing, but where small deferens as possible by the inguinal region, and reports a case although twenty-nine centimetres were removed by the inguinal operation.

(b) *Extensive Local Disease of the Epididymis and Surroundings.*—In cases where the epididymis is extensively diseased (abscess formation, fistula, or the testis at all involved), castration should be done if the disease is unilateral.

Many writers are found who claim that even this class of cases is curable by epididymectomy, curettement, cautery, etc.; and where both sides are involved, it is perhaps well to limit our operation to such measures on one side (but castration on the worst side); but when the disease is unilateral, there are many objections to the less radical procedures, among which are the length of time required for healing, and the frequent persistence of fistulæ, the danger of a dissemination of the infection by the blood, and the continuation of testicular disease.

(c) *Bilateral Testicular Disease.*—From a study of the reported cases, the operative indications appear to be the same whether one or both sides of the scrotum are involved.

It is true that bilateral disease is generally of worse prognosis, and accompanied, as a rule, by more extensive prostatic and urinary involvement; but that a perfect cure often results after simple removal of the disease on both sides, without any operation upon the prostate and vesicles, is shown by numerous cases in the literature. Among the twenty-seven cases of König⁶ followed for two years or more, there were thirteen cases of double testicular tuberculosis, with involvement of the prostate, in which castration was followed by perfect cure. Among Dimitresco's twelve cured cases after epididymectomy followed from one to nine years, there were four cases of bilateral disease.

As between the partial and complete operations, the indications are the same as in unilateral disease, epididymectomy

appearing to be just as satisfactory as castration where the local disease is not very advanced and the testicle appears healthy after opening the tunica vaginalis and resecting the epididymis.

Bilateral castration should certainly be avoided if possible, even where one runs the chance of a local recurrence.

(d) *Disease of the Seminal Vesicles and Prostate*.—The operative indications would seem to depend on what views are accepted as to the primary location of the disease, whether epididymis, vesicle, or prostate.

This question has already been discussed, and, as indicated above, it is far from settled. The large majority of clinicians believe that tuberculosis is most often primary in the epididymis, while a smaller number—Guyon, Lancereaux, and Kocher included—think the prostate to be the primary seat of disease. The operative results, as also set forth above, would seem to favor the epididymis as the initial location.

But, regardless of their opinions on this question, the fact remains that it has been thoroughly demonstrated that tuberculosis of the prostate or vesicles very often disappears after removal of the testicular foci. On this point all are agreed. (See Transactions Société de Chirurgie, 1899, reports by Reynier, Quénu, Berger, Sieur, Poirier, Routier, Reclus, Bazy, Delbet, and others.) The excellent report of Dimitresco⁷ furnishes many examples of the curative effect of epididymectomy upon disease of the prostate and vesicles, as does also the work of Bardenheuer.

But most conclusive of all is the report by König⁸ from the practice of Kocher, from 1887-1896, forty-five cases in all, with excellent clinical memoranda. Kocher does not favor the partial operation, and in this series has performed only three epididymectomies to thirty-seven castrations. Among the forty-five cases there are nine deaths, and nine cases could not be followed. Twenty-seven cases have been carefully examined after periods varying from two to nine years.

Of these twenty-seven cases there have been twenty-two cures of both local and distant tuberculosis, four with marked

improvement of the prostatic, vesical, or general condition, and only one unimproved.

The prostate or seminal vesicles or both were always carefully examined per rectum. In only fourteen of these were the prostate and seminal vesicles found uninvolved. Of the other thirty-one (five cases after having unilateral castration performed elsewhere), in eleven was bladder (or kidney) tuberculosis present, in five times involvement of the lungs, bones, or glands, and in one previous history of bladder disease. In nine cases was there only one nodule present in prostate or vesicle. Of the thirty-one cases in which the prostate or vesicles were involved, in seventeen was only one testicle diseased, and in fourteen both testicles. After operation the vas deferens was found entirely healthy in but three cases; only slightly diseased fifteen times, badly diseased sixteen times, five times up to the inguinal canal, once up to the prostate. Often there was the healthy middle part of the vas (the prostatic end being diseased).

Of the seventeen cases with the prostate and one testicle diseased, fourteen were followed with ten complete cures, one improvement, and three deaths. In thirteen cases (followed), where both testicles were involved besides the prostate, nine were cured (local and general), two improved, and two died. Eight cases died subsequent to operation; two of these had involvement of the urinary tract (bladder, kidneys) before operation; two, both lungs and urinary tract; one, the lungs alone; one, the osseous system; one, the glands. In only one of the fatal cases was the disease, before operation, localized to the genital tract (both testicles and prostate). In this case operation was followed by involvement of the bladder and kidneys, and death occurred four years later.

The other seven cases of previously generalized tuberculosis might justly be excluded, as the local operation could not be expected to cure these (although it did in several cases).

Deducting these and the cases not followed, we have thirty-three cases operated which did not have tuberculosis outside of the genital tract before operation, of whom twenty-

eight were followed (periods between two and eleven years) with twenty-two cures, four marked improvements (prostate, bladder, etc.), one unimproved, and one death (four years after operation).

The lungs were involved six times, with two cures and four deaths. The higher urinary tract eight times, with four deaths, two cures, one improved, and one not followed. Some of these cases and improvements after castration were indeed wonderful.

Kocher is of the opinion that castration has more effect upon prostatic tuberculosis than epididymectomy, owing, he thinks, to the more certain atrophy of the gland after castration. This, however, is strongly denied by French writers. and, as each has used the method he favors to the exclusion of the other, his evidence is robbed of much of its force.

But regardless of this question, the fact remains that removal of the focus of disease from the scrotum, whether by castration or epididymectomy, has a most wonderful effect upon disease of the prostate and seminal vesicles (twenty-eight cases, twenty-two cures, prostate or vesicles being involved seventeen times among the cured cases).

THE STATISTICS AFTER REMOVAL OF THE SEMINAL VESICLES.

The operation of excision of the seminal vesicles, first done by Ullmann in 1889, has now been performed in thirty-four cases for tuberculosis of the seminal vesicles associated with the testicular disease. The methods of reaching the seminal vesicles may be thus classified:

A. Puncture...	{	Rectal.	
		Perineal.	
B. Incision...	{	Rectal.	
		Perineal.	
C. Excision...	{	1. Inguinal method of Villeneuve	.....1891.
		“ Zuckerkandl by Ullmann	.....1889.
		“ Roux	.....1891.
		2. Perineal	“ Von Dittel by Schede.....1893.
		“ Guelliot	.....1895.
		“ Baudet	.....1898.
		3. Sacral	“ Kraske by Schede.....1895.
		“ Rydygier by Schede	.....1895.
		4. Suprapubic	“ Young.....1900.

As to the different methods outlined above, we have not the space to describe them at length. The inguinal method of Villeneuve consists in following the vas deferens through the inguinal canal by enlarging upon the usual inguinal hernia incisions, freeing of the vas along its course around the bladder, isolation of the seminal vesicle around the side of the bladder, and excision of both the vesicle and vas deferens.

In the perineal method, first employed by Ullmann in 1889, he made use of the Zuckerkandl curved transverse-perineal incision, the dissection being carried through the levator ani with isolation and excision of vesicle and vas deferens, which had been loosened from its higher attachments by an inguinal incision.

Since Ullmann's operation, various incisions, para-anal, circumanal, etc., have been used by the operators above mentioned, but these operations practically only differ in the direction of the cut, and are hardly worthy of the dignity of a special name. The method of Roux has been the most largely used. The sacral method has been used by Schede through both the Kraske and Rydygier incisions, the rectum being pushed to one side and the vesicle thus isolated and removed.

The suprapubic retrocystic method has been described at length by the writer in reporting his two cases in the first part of this paper.

The appended tabulations give the history of all cases in the literature. Doyen's case of complete excision of the prostate, and my case of resection of the bladder, although including excision of the seminal vesicles, are purposely omitted from this list.

Number of Case.	Name of Author and Journal.	Age of Patient.	History of Disease.	EXAMINATION.		
				General.	Local.	Urine, Bladder, etc.
1	Ullmann, Centralb. f. Chirurg. 1890, No. 8, p. 133.	17		No pulm. tub.	Tub. rt. epidid. vas def. and rt. sem. ves.	
2	Roux, Congress Français, Chirurg., 1891.	44	Duration 2 months.	No other tub.	Tub. left epidid. vas def. and left sem. ves.	Normal.
3	Roux, loc. cit.	50	Duration 4 months.	No pulm. tub.	Tub. rt. epidid. vas def. and rt. sem. ves.	Normal.
4	Villeneuve, Extract Congress, Marseilles, Sept. 1891.				Tub. 1 epidid. and 1 sem. ves.	
5	Roux, see ref. Guedroytz, Case IX.	62	Duration 3 weeks.	Robust man.	Tub. left epidid. vas def. and left sem. ves.	
6	Roux, loc. cit.	19	Duration 18 months, slow growth.	Healthy youth. No pulm. tub.	Tub. rt. epidid. vas def. and left sem. ves.	Normal.
7	Schede, Soc. M. Hamburg, Jan. 1895.				Tub. left epidid. vas def. and left sem. ves.	
8	Schede, loc. cit.		Previous double castration for tub.		Tub. both sem. ves.	
9	Sick, in Guedroytz Rev. Méd. de la Suisse Romande, Mar., April, 1899.		Castration left side, 2 months previously.		Tub. left sem. ves. and vas def.	
10	Schede, loc. cit.				Tub. left epidid. vas def. and left sem. ves.	
11	Schede, loc. cit.				Tub. rt. epidid. vas def. and rt. sem. ves.	
12	Schede, loc. cit.		Castration rt. side, 6 weeks previously.		Tub. both sem. ves. rt. vas def. and portion of left vas def.	
13	Weir, Med. Record, 1894, No. 46.	28	Left test. 6 months. Rt. test. 3 months.	Health good.	Tub. both epidids. vasa def. and both sem. ves.	Urine, pus and blood. Tub. bacilli only after pros. massage.
14	Roux, loc. cit.	46	Rt. sided castration 1 month before. Disease of left test. for 3 months.	Health good.	Tub. left epidid. both vasa def. and both sem. ves.	Normal.
15	Platon, Thèse Montpellier, 1898, p. 81.	33	Duration 4 months.	Health good.	Tub. left epidid. vas def. and left sem. ves.	
16	Guelliot, Presse Med., April 20, 1898.	20	Duration left epidid. 1 year. Duration rt. epidid. several days		Tub. both epidids. vasa def. and both sem. ves.	
17	Guelliot, loc. cit.	34			Tub. both epidids. rt. vas def. and rt. sem. ves.	
18	Routier. (Refer to Guelliot's article.)				Tub. both sem. ves.	
19	Roux, loc. cit.	18	Duration 3 months.	Frail youth. No pulm. tub.	Tub. left epidid. vas def. and left sem. ves.	Normal.

Date of Operation.	OPERATION.			Immediate Results.	Date of Discharge.	Ultimate Results.
	Method.	Parts Removed.	Complications.			
{ June 17, 1889. July 27, 1889.	Castration. Zuckerkindl.	Rt. test. both sem. ves. portion of rt. vas def. and rt. superior angle of prostate.	Severe hæmorrhage.	Continuation of disease. Good. No fistula.		Death several years later. Pulm. tub.
March 20, 1890.	Roux.	Left test. vas def. and left sem. ves.		Good. No fistula.	April 20, 1890.	Aug. 1898 (8 years after operation), complete cure, general condition good.
Feb. 21, 1891.	Roux.	Rt. test. vas def. and rt. sem. ves.		Rt. sided hemiplegia. Incontinence of urine.	May 15, 1891.	No fistula. No local recurrence. Died 4 years after operation. Pulm. tub.
Sept. 7, 1891.	Villeneuve.	One epidid. vas def. and one sem. ves.				
July 14, 1892.	Roux.	Left test. vas def. and left sem. ves.		Good. No fistula.	Aug. 20, 1892.	Oct. 15, 1898 (6 years after operation), no recurrence. Health good.
March 22, 1893.	Roux.	Rt. test. portion of vas def. and rt. sem. ves.	Part of tub. vas left.	Good. Fistula.	May 2, 1893.	
1893.	Kraske.	Left test. vas def. and left sem. ves.		Good. Fistula.		
	Von Dittel.	Both vasa and both sem. ves.	Local recurrence.	Good. No fistula.		
1893.	Von Dittel.	Left vas def. and left sem. ves.		Not good. Fistula.		Fistula. Recurrence of t. b. a few weeks after operation.
1894.	Rydygier.	Left test. and sem. ves.		Good. No fistula.	3 weeks after operation.	
1894.	Von Dittel.	Rt. test. vas def. and rt. sem. ves.		Fistula.		
1895.	Von Dittel.	Rt. vas def. portion of left vas def. and both sem. ves.		Good.	2 months after operation.	
Oct., 1892.	Villeneuve. Roux.	Both test. vasa def. and both sem. ves.		Probably bladder infection. Fistula.	Dec. 1892.	Increased bladder irritability, when last seen several months after operation.
June 18, 1895.	Roux.	Left test. left vas def. and portion of rt. vas and both sem. ves.		Good. Fistula.	Aug. 1, 1896.	Jan. 1899 (3½ years after operation), excellent condition. Fistula.
Jan. 17, 1896.	Villeneuve.	Left test. vas def. and portion of left sem. ves.	Rupture of left sem. ves. during traction on vas def.	Good. No fistula.	March 1, 1896.	About Dec. 1896 (1 year after operation), excellent condition.
June, 1895.	Guelliot.	Rt. test. vas def. and rt. sem. ves.		Good. No fistula.	Nov., 1895.	Mar. 1896 (8 months after operation), well.
Nov. 4, 1896.	Guelliot.	Rt. test. both epidids. rt. vas def. and rt. sem. ves.		Fistula.	Nov., 1896.	Died 2½ months after operation. Pulm. tub.
	Kraske.	Parts of both sem. ves.		Good.		
May 23, 1898.	Roux.	Left test. vas def. and left sem. ves.		Good. Fistula.	June 17, 1898.	Aug. 1898 (3 months after operation), well. No fistula.

Number of Case.	Name of Author and Journal.	Age of Patient.	History of Disease.	EXAMINATION.		
				General.	Local.	Urine, Bladder, etc.
20	Roux, loc. cit.	33	Duration 3 months.	Bronchitis.	Tub. left epidid. vasa def. and left sem. ves.	
21	Baudet et Kerdirdjy, Case I., Gaz. des Hôpitaux, Oct. 15, 1898.	17	Duration 2 months.	Anæmic. No pulm. tub.	Tub. rt. epidid. vasa def. and rt. sem. ves.	No urethral discharge. No disturbance of function.
22	Baudet et Kerdirdjy, Case II., Jour. Méd. de Bordeaux, Feb. 18, 1900.	26	Duration 2 months.		Tub. rt. epidid. rt. vasa def. and portion of left vas and both sem. ves.	Normal.
23	Chavannaz, Jour. de Méd. Bordeaux, Feb. 18, 1900.	28	Chronic symptoms 7 years. Acute, 2 mos. curettage.		Tub. left epidid. vasa def. and left sem. ves.	
24	Roux, ref. Hogge, loc. cit.				Tub. l. epidid. vasa def. and l. sem. ves.	
25	Bolton, Jour. Cut. and Gen. Urine Dis., Dec., 1899.	25	Tub. arthritis (hip joint) 15 years. Tub. rt. test. (castration) 4 years. Tub. left test. duration 2 years.		Tub. left epidid. vasa def. and left sem. ves.	
26	Moullin, Edinburgh Med. Soc., Jan. 8, 1900.				Tub. both sem. ves.	
27	Moullin, loc. cit.				Tub. sem. ves.	
28	Hogge, Trans. XIII. Inter. Congress, 1900, Gen. Urin. Section.	50	Curettage of rt. epidid. 6 months previous.	Advanced pulm. tub.	Tub. rt. epidid. vasa def. and rt. sem. ves.	Cystitis.
29	Villemain and Duval, Thèse (Paris) Reyt., Jan. 28, 1900.	2½	Orchitis 1 year. Incised 6 months ago. Fistula since.	Good.	Tub. left epidid. vasa def. and left sem. ves.	
30	Baudet and Duval, Rev. de Chirurg., March, 1901.	20	Duration 6 months. Fistula 2 weeks.		Tub. left epidid. left vasa def. both sem. ves. and upper portion of prostate.	Normal.
31	Young, Arch. f. klin. Chir. (Berlin), Bd. lxii, Hft. 3, 1900.	62	Duration tub. left test. 6 months. Rt. not suspected. Cough for 10 years.	Râles over upper portion rt. lung.	Tub. both epidids. vasa def. and both sem. ves. and portion of prostate.	No bladder symptoms. Urine—few leucocytes. No bacteria found.
32	Hutchinson, ANN. OF SURGERY, Oct., 1900.	28	Castration for tub. left test. 5 years before; for rt. test. 10 months before. Fistula. Pott's disease.	Good.	Sinus of groin. Tub. rt. vasa def. and rt. sem. ves.	Negative.
33	Walker, Md. Med. Jour., Feb., 1901.	27	Acute epididymitis 3 years before. Sinus formed 2 years before.	Good.	Sinus ecrotimus. Tub. both epidid. both sem. ves. and prostate.	Negative. No pus.
34	Young, unpublished.	30	Duration left test. 2 years. Rt. test. 10 days. Gonorrhœa twice, with epididymitis left.	Good.	Tub. both epidids. vasa def. both sem. ves. portion of prostate and left side of blad.	No bladder symptoms. Urine very purulent (source prostate).

Date of Operation.	OPERATION.			Immediate Results.	Date of Discharge.	Ultimate Results.
	Method.	Parts Removed.	Complications.			
Aug. 6, 1897.	Roux.	Left test. vas def. and left sem. ves.	Local infection, pyrexia considerable.	Slow healing. Fistula.	Nov. 29, 1897.	Aug. 1898 (1 year after operation), well. Fistula.
July 23, 1898.	Guelliot.	Rt. test. vas def. rt. sem. ves. and small adjacent portion of prostate.		Good. Fistula.		6 months after operation, tub. other epidid. Fistula excised.
Dec. 20, 1898.	V Incision, perineal.	Rt. test. rt. vas def. portion of left vas and both sem. ves.	Cystitis yields to treatment.	Good. No fistula. Pulm. râles.	Nov. 6, 1899.	No recurrence after 2 years.
Aug. 27, 1898.	Baudet.	Left test. vas def. and left sem. ves.				
1899.	Roux.	One test. vas def. and one sem. ves.		Good. Small fistula.		
1899.	Villeneuve. Rydygier.	Left test. vas def. and left sem. ves.		Good. No fistula.		
1899.	Roux.	Both sem. ves.		Good. Fistula.		
1899.	Roux.	Sem. ves.		Good.		
May, 1900.	Roux.	Curettage of right sem. ves.		Fistula.	June, 1900.	Relief of pain. One month after operation, good condition.
April 4, 1900.	Villeneuve.	Left test. vas def. and left sem. ves.		Good. No fistula.	May 4, 1900.	July 4, 1900 (3 mos. after operation), excellent condition.
July 13, 1900.	Villeneuve.	Left test. vas def. and left sem. ves.		Not good. Fistula Rt. sem. ves. involved.	Oct., 1900.	Jan. 1901 (6 months after operation), patient died of tub. meningitis.
June 9, 1900.	Young.	Both test. vasa def. both sem. ves. and upper portion of prostate. Small bladder ulcer.	Pulm. tub. Severe jaundice.			Death 3 weeks after operation.
Jan. 13, 1900.	Roux.	Rt. vas def. rt. sem. ves.	None.	Good, complete relief.	Feb. 17, 1900.	Exam. at times not stated, apparently in good health.
July 27, 1900, by Dr. Finney.	Villeneuve. Roux.	Rt. test. vas def. rt. sem. ves. portion of prostate, left sem. ves. left epidid. curetted.	First operative shock; later urinary fistula.	Rapid convalescence.		Exam. 6 months after operation, apparent cure.
March 2, 1901.	Young.	Both test. vas def. both sem. ves. and almost upper half of prostate. Cauterization of bladder ulcer.	None, except pyrexia.	Mar. 28, 1901. Condition good. Suprapubic sinus still open.		

SUMMARY.

Part removed: one testicle (or epididymis) twenty-three times, both testicles five, one seminal vesicle twenty-three times, both seminal vesicles eleven times, portion of prostate five times.

IMMEDIATE RESULTS.

Good, no fistula	13
Fistula	14
(In bad condition.....)	2)
Not mentioned.....	3

ULTIMATE RESULTS.

Twenty cases followed, fifteen cases with no note made excluded.

Result.	Length of time observed.
Death, jaundice, pulmonary tuberculosis....	Three weeks.
Local recurrence, fistula	"A few weeks."
Well	One month.
Death, pulmonary tuberculosis.....	Two and a half months.
Cure	Three months.
Well	Several months.
Well	Several months.
Bladder involved	Several months.
Cure	Six months.
Recurrence	Six months.
Death, meningitis	Six months.
Well	Eight months.
Well, with fistula	One year.
Well	One year.
Well	Two years.
Well, with fistula	Three years and a half.
Death, pulmonary tuberculosis.....	Four years.
Well	Six years.
Cure	Eight years.
Death, pulmonary tuberculosis.....	"Several years."

Results.—Twenty cases, five deaths, ten well, four recurrences. Only eight cases were followed over one year; of these two died of pulmonary tuberculosis, two had perineal fistulæ, four were cured. In only one of the five fatal cases is there any record of pulmonary involvement before the operation, and in only four cases was there any involvement of the bladder, and in three of these cases it was very slight. No history of kidney disease is recorded.

Considering, then, that both seminal vesicles were found involved in only eleven of the thirty-four cases, the infrequency of lung and bladder tuberculosis, the absence of kidney complications, the thirty-four cases on which spermatocystectomy has been performed may be regarded as not as serious cases on the whole as many of those in Kocher's list.

When compared with Kocher's twenty-eight cases (followed from two to eleven years), with twenty-two cures (lungs involved, two; kidneys, two), four marked improvements, one unimproved, and only one death, the showing made by operations upon tuberculous seminal vesicles is indeed poor.

It is true that many of Kocher's cases were not as severe as all of the spermatocystectomy cases were, and the same is true for the epididymectomy cases of Bardenheuer; but, granting due allowance for these facts, the fact remains that the results obtained by operations for removal of tuberculosis seminal vesicles are poor.

I am free to confess that this study of the literature has completely changed my views upon the subject, and I do not now feel satisfied as to the advisability of attacking tuberculous vesicles.

*The Operative Indications may thus be Summarized as follows:—*Epididymectomy with high resection of the vas deferens is the operation of choice.

Castration should be confined to cases where the testicle proper is involved, or the scrotal disease is extensive.

Double castration should be avoided if possible, a portion, at least, of one testicle being left, even with the risk of local recurrence of the disease.

Operations upon the seminal vesicles and prostate should only be done after removal of the testicular foci has failed to arrest the progress of the disease in these organs, and it has spread to the bladder.

Serious involvement of distant parts—pulmonary, urinary, osseous, etc.—does not contraindicate operation, especially since the more exact methods of using cocaine have made general anæsthesia unnecessary.

That remarkable disappearance of extensive tuberculosis of the prostate, seminal vesicles, bladder, kidneys, lungs, etc., may follow the simple removal of the testicular foci seems abundantly proven.

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CERVICAL RIBS.¹

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IN looking over the rather extended literature of cervical ribs, it is evident that the interest of anatomists in this peculiar anomaly was much earlier aroused than that of surgeons. The reason for this is easily established. Pilling,¹ in 1894, was able to collect 139 cases of cervical ribs, there being included in this number only three cases in which the abnormal condition had given rise to clinical symptoms. Coote,² in 1861, published the first case of resection of a supernumerary rib, which had caused symptoms of compression of the brachial plexus and the subclavian artery. His case is a very unusual one, in so far as the rib itself was not the direct cause of pressure, the latter being rather due to an exostosis springing from the rib, as the specimen after operation distinctly showed. The next resection of a seventh cervical rib was done by Perier and described by Planet³ in 1890. It resulted in an immediate cure of all the symptoms, which in this instance were solely due to pressure on the plexus. The third case of operative interference for a cervical rib seems to be the one of Fischer,⁴ who in 1892 removed the offending member and cured his patient. In a previous publication, Fischer had called attention to the clinical importance attached to this condition; but it is only since his later publication, first mentioned, that individual reports of successful operations have become more frequent. We should not infer from this, however, that the con-

¹ Read before the New York Surgical Society, April 24, 1901.

dition had not previously been recognized and described, and also treated, as it appears, very successfully, without surgical intervention. Such cases are recorded by A. Cooper in 1818; by Hodgson in 1815; by Adams in 1839, and Poland in 1869, all of which are generally mentioned in the clinical reports of the last ten years.

Supernumerary ribs are more frequently found attached to the lumbar than to the cervical vertebræ. In the former location they have never, to my knowledge, caused any annoyance by their presence, for they are not in close relation to vital parts. As such relations do exist in supernumerary cervical ribs, it may not be amiss to recall some salient anatomical features of the latter. They are invariably attached to the seventh vertebra, and in the large majority of cases occur on both sides. They are most frequently of unequal development.

I have found only two cases⁵ on record in which an additional rudimentary sixth cervical rib was present; and one other case⁶ in which a rudimentary rib sprang from the sixth cervical vertebra, but none from the seventh. The supernumerary rib is most always connected with the seventh vertebra by an articulation at the body and at the transverse process of the latter; but occasionally no articulations are present, and the rib is firmly attached at these points to the vertebra. The most important point in the anatomy of the cervical rib is its length and the position of its anterior extremity. Various classifications have been made, based on the differences which supernumerary ribs show in this respect. Gruber's classification has been generally accepted, but I will quote Blanchard,⁷ who has somewhat, I think, improved on the former. He distinguishes five groups.

(1) In which there is a complete supernumerary rib attached to the sternum; only one autopsy recorded.

(2) In which the cartilage of the supernumerary rib is united with the cartilaginous end of the first dorsal rib; also a rare occurrence, but more common than the first variety.

(3) In which the two extremities of the rib are developed as bony structures, but the intermediate portion is represented by a band of fibrous tissue.

(4) In which the two extremities of the rib are developed, but not united by a fibrous band. The anterior extremity may be of bone or cartilage, and it may be attached to the sternum or to the cartilage of the first rib. The posterior extremity is always attached to the seventh cervical vertebra, and its anterior end is either free or united to the first rib by an articulation or by bony tissue.

(5) In which the supernumerary rib is represented only by a segment attached to the vertebra, and there is no indication of an anterior extremity.

The above classification is of some value for a proper appreciation of the clinical importance of supernumerary cervical ribs; for the reason that the subclavian artery and the brachial plexus always pass over the latter, whenever its anterior extremity reaches far enough forward, in which instance symptoms of compression may at any time appear. This, however, does not exclude the possibility of the existence of cervical ribs of the most perfect type without any symptoms whatever. Short ribs, not extending much beyond the end of the transverse process of the vertebra, or those in which the extremities alone are fully developed, the body of the rib being replaced by a fibrous band, are not likely to cause symptoms. From another point of view it is well to bear in mind the classification above mentioned—from that of surgical interference.

The removal of relatively short ribs has generally proven a very facile surgical undertaking, but I believe that the removal of a sufficient piece of the bone, when the supernumerary rib is attached to the sternum or thereabouts, can turn out to be a rather difficult task; so it was in my case, at least, which I will now report.

E. E., thirty-five years old; married fifteen years; two children; no miscarriages; has always been healthy. After an injury in her tenth year,—a fall on the left elbow,—a hard lump

was for the first time discovered by her physician in the left supraclavicular region. This gave no trouble until eight years ago; at that time, for a lapse of two years, she suffered from pain and weakness in her left arm, so that she could use it only for very light work. Medical treatment did not seem to improve this condition. Operative interference, at the time, was advised by her physician, but not accepted by the patient. Gradually the symptoms subsided, and she has had full use of her arm for the past six years, doing all kinds of hard work. About ten years ago, before her arm began to trouble her, she was very hoarse for a period of three weeks, hardly being able to speak above a whisper, although she does not remember having had a cold. Her present illness began in September, 1900. Without any apparent cause she had a feeling of pins and needles in the palm of her left hand, which gradually developed into shooting pains extending through the entire arm to the shoulder. During November, she noticed an inability to fully extend the left elbow. Gradually the pains now became so severe that she could not sleep at night. They were always confined to the upper extremity and never radiated to the back, neck, or chest.

January 15, 1900. Patient is fairly nourished, but somewhat anæmic, lungs and heart are sound. In the left supraclavicular region a slight bulging is noticeable, which, according to the patient's statement, varies considerably in size at different times. On moderate pressure a very hard tumor can be made out about the size of a walnut; but it is impossible to determine its attachment to the adjacent osseous structures. Immediately anterior to it, and very superficially, pulsation of the left subclavian artery is easily felt. Pressure on the tumor causes pain radiating down to the finger-tips; the left upper extremity is distinctly atrophied, measuring in circumference in the upper third of the humerus one inch less than the right, and at the forearm three-quarters of an inch less than the right. Sensation seems to be intact. Pulsation is distinct in the axillary artery, but farther on it cannot be felt either in the brachial, radial, or ulnar arteries. After exertion, especially in cold weather, the hand becomes perfectly white and anæmic, but it quickly recovers when warmth is applied.

The diagnosis rested between an exostosis and a supernumerary rib. I must confess that at the time I had only a very inac-

curate conception of the clinical importance of a cervical rib, but later on I found that the literature of the subject was quite large. Unfortunately, also, I was unable to procure an X-ray picture of the patient before operation. Still, I naturally leaned towards a diagnosis of a supernumerary rib, owing to the early discovery of the tumor when the patient was only ten years old.

Under ether an incision was made about four inches long parallel to and about one-half inch in front of the border of the trapezius muscle; from the centre of this incision another was carried, at right angles, towards the inner third of the clavicle. The flaps of skin and subcutaneous tissue thus outlined were dissected back and the deeper parts exposed; the cervical plexus and the subclavian artery came into view, and also the scalenus anticus and posticus muscles. The wound was now deepened at the posterior border of the plexus and the bony tumor exposed. The latter proved to be a rib taking origin from the vertebral column and extending forward towards the sternum beneath the plexus and subclavian artery. The scaleni muscles were attached to it; some fibres of the median passing over its lateral border to insert themselves on the first rib. It was a simple matter to expose the posterior portion of the rib, having hooked and drawn the plexus forward. The rib was divided with a cutting forceps at a point well behind the posterior edge of the brachial plexus, care having been taken not to denude it of its periosteum; after division, the anterior portion remained absolutely immovable, showing that it was firmly attached either to the first rib or to the sternum. It was with considerable difficulty that I could now free a sufficient portion of bone in an anterior direction to permit another section and the removal of a piece of bone about one and one-half inches long, owing to the proximity of so many vital parts. In my efforts to reach well towards the sternum, the subclavian artery was exposed for about two inches and pulled in various directions with a blunt hook. It seemed to be of normal size, but pulsated rather faintly. Upon removal of the bone the vessel and the plexus immediately dropped into the groove thus established between the cut ends of the rib. With a rongeur I removed as much as I could safely reach of the anterior segment, but, as already stated, I could not determine the exact point of attachment of the supernumerary rib to the thorax.

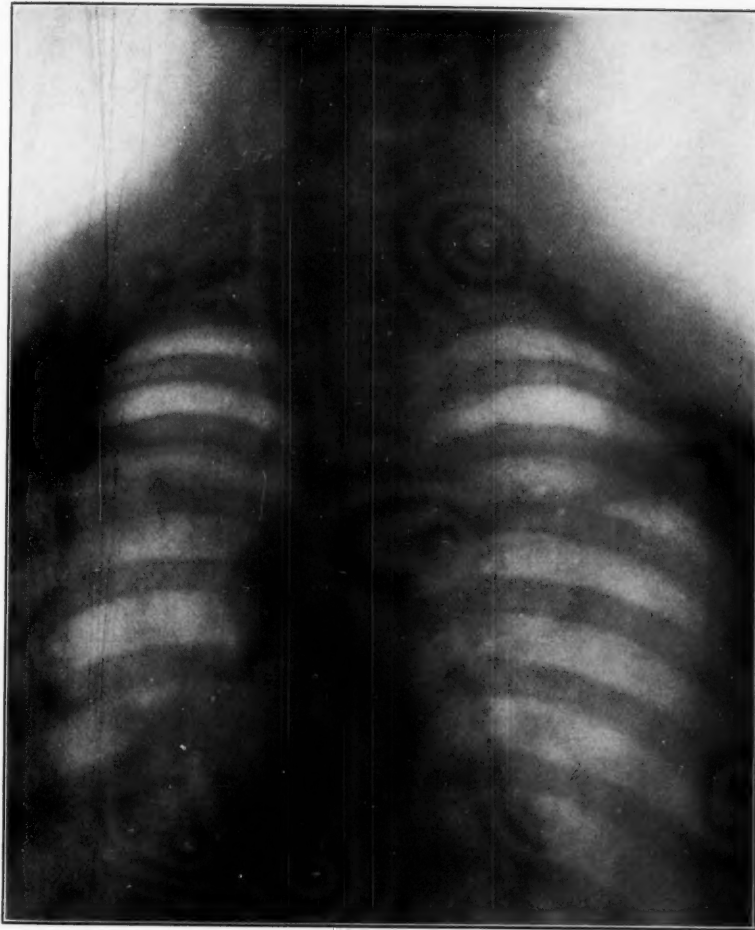
The wound was closed by sutures with the exception of a small opening at the point where both incisions met. Here a small tampon was inserted. Reconvalence was uneventful.

The improvement following operation in this case was a gradual one; during the first week the pains were rather more severe, and it was only after about four weeks that they gradually subsided. At that time she could entirely extend the elbow to a straight line; she could place her hand on the top of her head. Even at the present moment, three and a half months after operation, she cannot fully raise her arm in the shoulder. The pulse has not returned in the ulnar, radial, and brachial arteries; the same amount of atrophy of the muscles is still present in the arm and forearm. But from a condition of complete uselessness the limb has again been restored to almost normal activity.

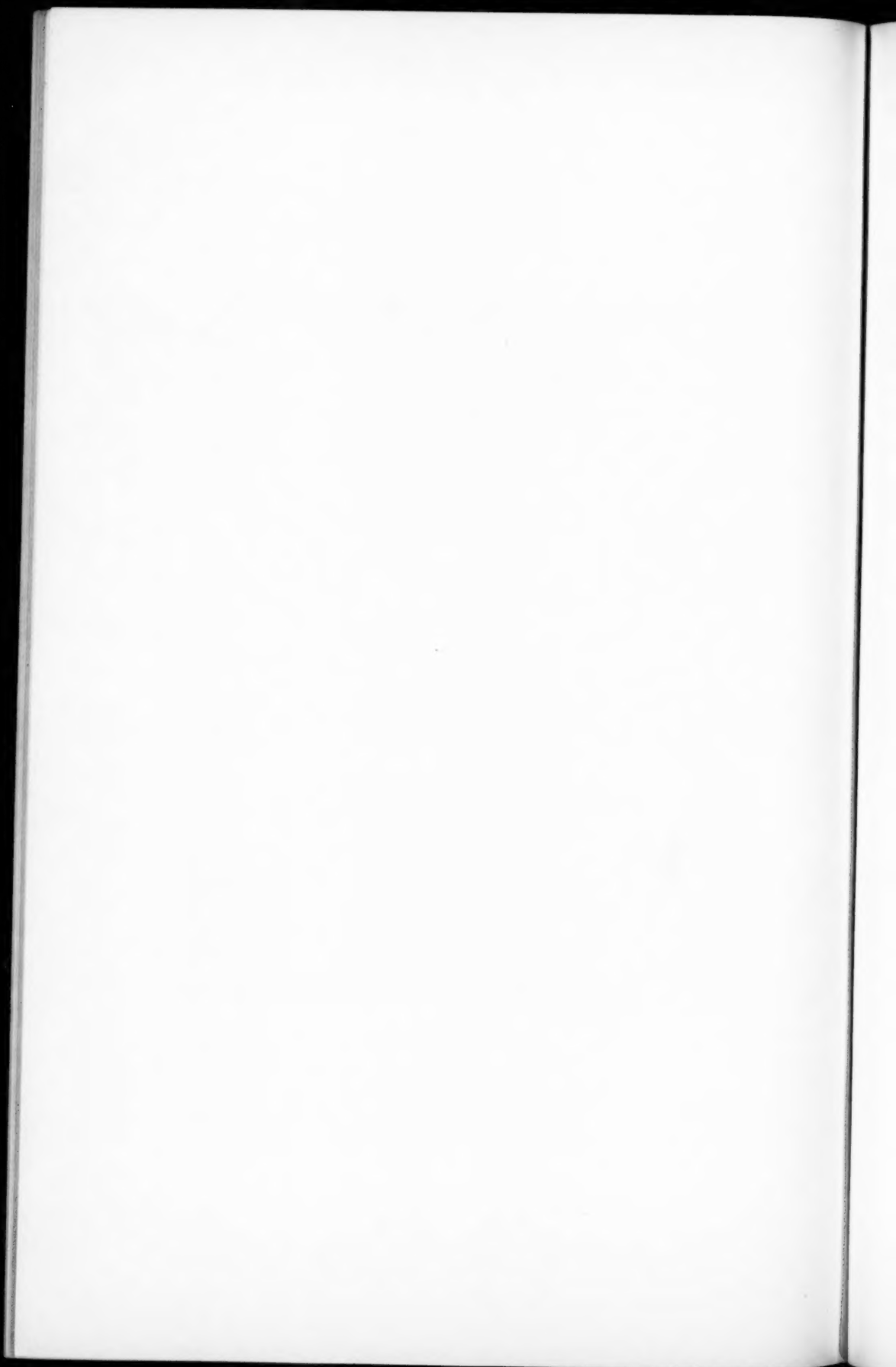
An X-ray picture, which was kindly taken for me by Dr. George W. Jacoby some weeks ago, shows distinctly the point at which the supernumerary rib on the left side was cut near the seventh cervical vertebra. It also clearly shows the total absence of a similar condition on the right side. Although many sittings were held and uniformly good plates developed, we were not able to get a clear picture of the sternal end of the supernumerary rib. However, the anterior extremity must be attached either to the sternum itself or to the costal cartilage of the first dorsal rib very near the sternum. This I conclude from an examination of the patient to-day, at which the anterior end was easily felt, though it could not be followed to its point of attachment. I also came to the same conclusion at the time of operation. Nowhere was there any indication of a union with the first dorsal rib, and the direction of the remaining piece of the cervical rib was exactly towards the left corner of the manubrium. We are, therefore, dealing, in this instance, with a very rare variety of the anomaly,—that of a fully developed cervical rib on the left side and no trace of an abnormal development on the right.

With the aid of the X-rays the diagnosis of a cervical rib can be easily made, and in the recent literature on the subject several excellent pictures are reproduced (Bonnarme and Grisson).⁸

The bony tumor in the supraclavicular region, if not



Cervical rib—Kammerer.



recognizable by simple inspection, is readily palpated. The only condition with which it has been confounded is an exostosis of the first rib, which is said by Mesnard⁹ to cause pressure symptoms even more frequently than a cervical rib. Here, again, in the differential diagnosis, the X-ray will be of assistance.

A great many points of interest have been raised in reference to the symptoms caused by cervical ribs. The same are always due to pressure upon the brachial plexus and the subclavian artery. It is evident, if we bear in mind the varying degree of development of the ribs, that in shorter ribs the brachial plexus may be more liable to compression than the subclavian artery, and the cases on record bear out this view, inasmuch as some of them presented symptoms of pressure on the nerve trunks only. On the other hand, cases of isolated pressure on the artery have to my knowledge not been reported; although it should not be forgotten in this connection that the latter are more readily overlooked by the patient than the former. Symptoms of pressure on the plexus have been identical in almost all the cases reported; formications and numbness in the hands and fingers, neuralgic pains shooting through the entire extremity and occasionally radiating to the shoulder and the anterior wall of the thorax (posterior thoracic nerve). While no degeneration reactions have been observed, there is always a loss of muscular power in the entire extremity. An unusual symptom, occasionally observed, is the inability of the patient to fully extend the arm in the elbow-joint. This was very marked in my case, and is also mentioned as occurring in the first of Ehrich's cases. Hoarseness has been ascribed by Planet to pressure upon the recurrent nerve. Whether or not this symptom in my patient had any connection with the supernumerary rib I would not venture to say; it is certainly strange that it has not recurred at a time when other symptoms of pressure were most marked. On the whole, we may say that the disturbances caused by compression of the brachial plexus are rather sensory than motor.

Pressure upon the subclavian artery occasionally leads to the formation of aneurisms in that portion lying between the rib and clavicle in the supraclavicular space and to thrombosis in the arteries of the upper limb. In one case (Karg)¹⁰ the aneurism developed after removal of the rib; but here, as well as in the other cases, compression was sufficient to effect a cure or, at least, a diminution in the size of the pulsating tumor in every case. It is not, therefore, surprising that Tilmann should counsel against extirpation of the supernumerary rib in cases complicated with aneurism, believing that compression of the latter is far easier and more effectually accomplished with the rib still in place. Most of the cases of aneurism were complicated with thrombosis of the brachial artery and its branches, but the latter condition also occurs as the result of pressure upon the subclavian without the formation of an aneurism, as in my case and in the cases of Madelung¹¹ and Coote, where pulsation in the arm has ceased before operation, and did not later on return (Madelung's case six months, in mine three months) after removal of the rib. In these cases sufficient collateral circulation has evidently been established before the operation, but the change, although coming to the perception of the patient slowly, has, nevertheless, left some marks. The temperature of the arm is lower than on the sound side, and the hand turns anæmic and white upon the slightest exertion. This was one of the most annoying symptoms to my patient, and it still persists, as it evidently should after what has just been said. In a few cases gangrene of the finger-tips has resulted after slight injury to these parts, but on the whole no very serious nutritive changes have been observed.

Opinion seems to be divided as to the cause of muscular atrophy,—some authors attributing the same to compression of the nerves, others to the diminished blood supply. I rather incline to the latter belief from my own experience. The muscles of the left arm of my patient were in the same condition three and a half months after pressure on the plexus had been removed as they were before the operation. The blood supply has not, of course, been increased by the latter.

Much speculation has been indulged in as to the nature of the compression exerted by the supernumerary rib. If the latter is fully developed and reaches the sternum, it seems probable that the subclavian vessels and the plexus will adapt themselves, during further development, to these conditions, and will pass over the additional rib as easily as they do normally over the first dorsal rib. This view is certainly strengthened by the fact that so few cervical ribs cause any symptoms at all. But why, on the other hand, should symptoms develop more or less suddenly in persons who have carried their cervical ribs from twenty to fifty years without molestation? In some cases a trauma has been accused of causing a development of symptoms, such as the violent extraction of a cork from a bottle, the wearing of a knapsack with shoulder-straps, or a fall upon the shoulder; we must confess not a very convincing array of facts to establish this etiology.

Still another explanation, which has been ventured by Tilmann, and has later on found a supporter in Gronauer,¹² is the following: A number of the cases reported, in which accurate histories are given, Tilmann observes, have suffered from debilitating diseases for some time before the onset of symptoms, such as pleurisy, pneumonia, chlorosis, phthisis, alcoholic tremor, and rheumatism. Most of these patients are said to have fallen off considerably in weight. The adipose tissue in the supraclavicular space, as is well known, disappears quickly in all cases of rapid emaciation. Owing to this, Tilmann thinks, the artery and plexus are deprived of their natural support, and now resting upon the bony rib are more liable to pressure. I cannot say that this explanation appeals to me very much from a mechanical point of view, and Tilmann himself does not appear to press it very enthusiastically. Hirsch¹³ believes that in his case a periostitis of the rib had narrowed down the space between the latter and the anterior and median scalenus muscles to such an extent as to cause compression of the brachial plexus.

When we consider the number of well-developed cervical ribs that have caused no symptoms for a long time, in which

suddenly very urgent symptoms have developed that have again disappeared as rapidly under appropriate medical treatment, never perhaps to return, or only after many years, when we take all this into consideration, I think we are compelled to admit that in some cases at least, besides the abnormal congenital condition, another directly causative factor must be at work in the production of compression.

Many of the cases recorded have been improved, apparently even cured, by suspension, massage, electricity, poultices, and the like. In a few the subjective symptoms after persisting some time (in my case two years) have disappeared without treatment, to reappear again after a greater or lesser interval. When the symptoms caused by the cervical rib are simply those of moderate pressure upon the plexus, non-operative treatment is indicated. When this is ineffectual or the symptoms recur, removal of the rib should be considered. When signs of compression of the subclavian artery are present, operation is always indicated, provided an aneurism has not developed.

Before concluding, I desire to refer once more to the technique of the operation for the removal of a cervical rib. The operation seems to have been in most cases a rather easy one, for no mention is made of technical difficulties in the publications on the subject. Gronauer even says, "*la technique opératoire est des plus simples.*" My impression is that the operation is either very easy or rather difficult; and the simplicity of the procedure in most of the cases reported is based on the fact that the distal end of the rib had not reached beyond the point at which the subclavian artery emerges from the thorax. In such cases (those of Madelung, Karg, De Quervain,¹⁴ Fischer, Warren,¹⁵ Gronauer) the operation must, indeed, be a simple one, whether the distal end of the rib is attached to the first dorsal rib or not. The brachial plexus and the subclavian artery are readily drawn forward, if this be at all necessary, and the posterior extremity of the rib is quickly exposed for a sufficient distance to permit its division well out of reach of the plexus. In a few cases the artery and the

plexus have not even come into view during dissection. The fibres of the scalenus medius, which are attached to the supernumerary rib, should be divided. But when we are dealing with an anterior extremity of the rib which has passed underneath the subclavian artery, the surgical problem at once assumes another aspect. Planet's case was of this nature; and, while I have not been able to procure his original communication, I can quote from Tilmann, who says that extirpation of the rib was accomplished with much difficulty. In Tilmann's own case the rib passed "down into the thorax after crossing the clavicle, and a point of insertion on the first dorsal rib was not discovered." From Tilmann's remarks, I gather that the operation presented some difficulties in his case. In my patient the removal of what I considered a sufficient piece of bone from the sternal end was a very laborious task. Tilmann has proposed in such cases to approach the rib from the anterior side of the artery and the posterior of the plexus, working one's way towards its middle portion. This suggestion did not work well in my case. I had to abandon the attempt to divide the rib before the subclavian artery, as drawing the latter well forward and pulling the plexus backward seemed to give a much better exposure of the anterior part of the rib. A transverse incision through the skin should always, I think, be employed in these cases, whether it be supplemented by one in a longitudinal direction or not.

Finally, an accident should be mentioned as frequently occurring during the manipulation of freeing the lower surface of the rib,—the tearing of the pleura,—which has never given any serious trouble. It did not occur in my case.

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SKIN-GRAFTING IN THE TREATMENT OF COMPLETE STENOSIS OF THE LARYNX.¹

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It is well known that stenosis of the larynx and trachea of greater or less degree occasionally results from injury to its mucous membrane or deeper structures. Such injury may be due to acute laryngitis, diphtheria, traumatism whether of accident or of operation, tuberculosis, syphilis or destruction by new growths, or suppurative inflammation.

The subject of postdiphtheritic stenosis has recently been ably presented by Rogers (*ANNALS OF SURGERY*, 1900, xxxi, 547). There still remains, however, the consideration of cases where, following a tracheotomy performed because of obstructive or destructive disease, stenosis, or even complete obliteration of the laryngeal canal, has resulted. Scores of such cases have been reported, but it is only recently that cures have been reported as the result of some of the various procedures which have been employed for the relief of this serious condition. Formerly, attempts were made to render the larynx permeable by means of silk or linen threads, tents, bougies, etc., and to keep it dilated by one of the various and ingenious dilators devised for this purpose. More recently, intubation tubes of gradually increasing size have been employed. By such methods, aided at times by intralaryngeal division of the stricture, a few of the milder cases of stenosis have been cured. The majority—at least, of the severe cases—were, however, unrelieved, and the patients were obliged to breathe

¹ Read before the New York Surgical Society, April 10, 1901.

for the remainder of their lives through a tracheotomy tube, the inconveniences and risks of which it is not necessary to discuss.

Out of a considerable number of reported cases, the following, reported by M. Boulay (*Transactions of the Twelfth International Medical Congress*, Vol. iii, Sec. 6, p. 91) is typical. It is as follows:

A child, four and one-half years old, was intubated because of dyspnoea due to diphtheria. For seven months faithful attempts were made to dispense with the tube, but in vain. A subglottic infiltration of the tissues and an œdema excited by the slightest intralaryngeal irritation were the cause of the obstruction. With the aid of chloroform, systematic efforts were made to dilate the opening by sounds and progressively enlarging intubation tubes. This, with many variations in the appliances employed, was faithfully carried out for another eighteen months, but at the end of this time the child was still obliged to wear an intubation tube.

The treatment in this case was pursued by a skilful operator for more than two years, and yet cure did not result. Many other similar failures have been reported.

In the treatment of more severe cases,—and it is with these that the present paper deals,—where the entire, or at least the greater, part of the length of the larynx has become so blocked with new tissue that it is entirely impermeable to either air or to a probe, the greatest difficulties present themselves. There are specimens in existence which show a complete blocking of the windpipe from the epiglottis downward to the trachea by dense cicatricial tissue. There are cases, also, where the cartilages have been almost completely destroyed. For the cure of such many clever operative procedures have been devised and practised. Failure, however, has generally followed, in spite of painstaking and ingenious methods of treatment by mechanical devices and by operative procedures. It is true that in a few cases excision of the strictured portion of the larynx or trachea, with union of the divided ends, has

been employed with success. (Langenbeck's *Archiv*, 1881, von J. Gluck and A. Zeller Colley, *Deutsche Zeitschrift für Chirurgie*, Band xl, p. 150.) This method is only applicable, however, where the stenosis is limited in extent, and where the greater part of the larynx or trachea is in a healthy condition.

Extirpation of the diseased larynx has also been done in certain cases; but this procedure improves but little the condition of the patient, unless an artificial larynx be substituted, the practicability and utility of which are doubtful. And at best it is but a very miserable makeshift for a patent laryngeal canal even though the vocal cords have been completely destroyed.

Various plastic operations have been devised and practised for the relief of this condition. One of these consists in dissecting a flap from the anterior chest wall, consisting of skin, periosteum, and a thin layer of the sternum, and its formation in a tube which shall in part or in whole replace the laryngeal canal (Schimmelbusch). This method is especially applicable to cases where the cartilages have been destroyed. The results, however, have been disappointing. Another such operation has been practised by Fritz König, in which he utilized a thin layer of skin and cartilage shaved from the thyroid cartilage. This method is applicable only for exceptional cases where but a small area has to be covered. For the same purpose, the cartilage of a rib has also been employed by v. Mangold.

Another class of operations consists in the so-called operation of laryngo-fission, where the larynx and, if need be, the trachea are divided vertically in the median line. The obstructing material, which generally consists of cicatricial tissue, is dissected out, and in its place some special form of intubation tube inserted. Whether the incision through the anterior laryngeal wall be resutured or be left open, contraction with the replacement of the cicatricial tissue almost invariably results. Many failures after this operation have been reported.

In recent years a great step in advance has been made in the prevention of recontraction, after the patency of the canal

has been re-established, by the employment of skin-grafts after the method of Thiersch. With these grafts the interior of the canal is lined. This may be done at once, or, what is generally preferable, the newly formed canal is packed with gauze for a number of days and the graft then applied. This method was first employed by Gersuny (reported by Galatti, *Jahrbuch für Kinderheilkunde*, Vol. xlii). His case was but a partial success. Lenart reports (*Pesther Med. Chir. Presse*, 1900, No. 19) the case of a man from whose entire larynx and upper trachea the mucous membrane bearing numerous papillomata was peeled off and in its place was substituted Thiersch's skin-grafts. Herczel reports a similar case, with, however, an imperfect result. H. Alapy (*Centralblatt für Chirurgie*, No. 52, 1900) reports a case of a four-year-old child who was intubated for diphtheria. Later a deep tracheotomy was performed. For nearly a year attempts were unsuccessfully made to cure the resulting stricture by tracheal fission, tubes, and dilators. Finally, the interior of the windpipe was skin-grafted, and in a week or so the canal was closed by suture. Another ten months elapsed, however, before the tracheal fistula was closed and the child could breathe through the natural passages.

In the case which I am about to report, the contraction due to destruction of the mucous membrane caused by an operation for removal of intralaryngeal growths had existed for over four years, and the entire laryngeal canal and upper part of the trachea, filled with dense cicatricial tissue, had been entirely obliterated.

CASE.—R. C., aged fourteen years. In 1895 the operation of laryngo-fission was performed for multiple papillomata of the larynx. At that time tracheotomy through the third and fourth rings was done, and a tube inserted. Since then the tube has been constantly worn. As far as is known, no attempts were made to dispense with it. On inspection through the mouth with a laryngeal mirror it was impossible to see the opening into the larynx on account of its closure by the epiglottis, which was tightly bound down over it by cicatricial tissue. A probe passed through the tracheotomy opening met a complete obstruction

half an inch above. It was evident that the windpipe from the epiglottis down to the second ring of the trachea was completely obstructed. As the boy was desirous to breathe through the natural opening, he was referred to me for treatment by Drs. Weightman and J. C. Sharpe.

Operative procedures were begun in November, 1900. On the 27th chloroform was administered through the tracheotomy tube. A three-inch incision was made in the median line of the neck from half an inch above the tracheal fistula to the hyoid bone. The larynx was found much shrunken and deformed. On cutting into it no canal could be found. The windpipe had become much contracted, and the cartilages enclosed a solid tube of cicatricial tissue without sign of calibre or mucous membrane. Attempts were made to pass a probe upward through the glottis, but this could not be accomplished. In order to give freer access, the hyoid bone was divided. While the laryngeal walls were held apart, some of the cicatricial tissue was excised. Considerable bleeding, especially from the upper part of the incision, followed, and it was considered best to simply tampon the new and narrow canal with a strip of gauze. Communication into the trachea had not been established, as the incision extended down to the first ring only of the trachea, and consequently no special efforts were needed to prevent blood trickling into the lungs. The wound in the larynx was kept open with difficulty with gauze until December 10, when chloroform was again administered, the laryngeal walls spread apart by retractors, and a considerable amount of cicatricial tissue excised. Dr. Sharpe kindly assisted me, and was able, by means of his finger through the mouth and a forceps pushed up from below, to push up the shrivelled epiglottis and to stretch the cicatricial contraction of the glottis so that a rubber tube, No. 22 (F.), could be drawn upward. The remainder of the trachea was then opened and cleared of its cicatricial tissue, and the rubber tube laid in the new canal, its lower end, to which a string was attached, extending down to the opening in the trachea, and its upper end, to which also a string was attached, projected out of the mouth. One suture of silk about the middle of the larynx drew its edges together and aided in retaining the rubber tube.

On December 18 chloroform was again administered, the tube removed, the new laryngeal and tracheal canal made still

larger by excision of more cicatricial tissue, and after all hæmorrhage had ceased, its interior, from the first tracheal ring to within half an inch of the glottis, was grafted by a Thiersch's graft taken from the thigh. This was rolled around a rod of gauze covered by rubber tissue, which was inserted with the raw surface of the graft against the bleeding surface of the new tracheal canal. The section grafted was about three inches in length. Through the glottis a silk thread was carried, emerging through the mouth. The graft "took" throughout its entire length, and on January 8, 1901, the anterior wall of the windpipe was formed by dissecting loose the skin edges of the wound and uniting them by suture in the median line, a tube the size of No. 22 (F.) being inserted, its lower end resting against the tracheotomy tube and its upper end projecting through the mouth, strings being attached to each end and fastened to the patient's neck and chest.

On January 10 the tube accidentally slipped out. It could not be replaced without chloroform. The wound healed kindly, and a new windpipe, comfortably carrying a tube of No. 24 (F.), was established. This tube was worn with an occasional change until April 6, when a tube of No. 28 (F.) easily replaced the smaller tube, and through this the boy could breathe comfortably. Its large size, and the fact of its being made of soft rubber, however, produced so much œdema of the glottis that it was decided best to replace it with a tube of No. 24 (F.), which was easily worn, and through which the boy breathes comfortably. Since April 10 an intubation tube has been worn, and through this respiration is comfortably maintained, the tracheal opening being closed by a pad of gauze. As there are no arytenoids or projections to maintain the intubation tube in place, it is occasionally expelled, and is sometimes not replaced for hours, during which time the boy breathes through his larynx. It is deemed wise to insist on his wearing an intubation tube, at least intermittently, for some months longer, until all danger of recontraction of the glottis above the site of grafting has passed. There is no question, however, that at the present time he could dispense with both the tracheal opening and his intubation tube, as on May 1 and 2 the tube for twenty-four hours was not *in situ*, and yet, with the tracheal opening closed, the patient was perfectly comfortable. At a later date the tracheal fistula will be closed.

ANORECTAL TRANSPLANTATION.

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COMPLETE paralysis of the sphincter ani uncomplicated with other lesion, either general or local, is a rare affection. It is a common symptom in paraplegia, in general paralysis, in acute diseases, inflammatory or febrile, where the patient is in a typhoid state, in laceration of the pelvic floor in childbirth, etc. In many of the acute cases the sphincteric action is regained with the patient's restoration to health, or as the result of surgical interference. The results of medical or surgical treatment in chronic cases is, with rare exceptions, so unsatisfactory that the patients are dependent on some of the various forms of mechanical appliance for any relief they may obtain. The operation resorted to in the following case of paralysis of the sphincter uncomplicated with other lesion is, as far as I know, novel; the history, however, is presented not on account of its novelty, but its benefit to the patient.

P. C., male, aged thirty-nine years, butcher, entered St. Peter's Hospital, October 17, 1900. Five months previous to his entrance, while bending over his work, an ungrateful steer, for which he was preparing food, ran one of his horns into the patient's rectum, inflicting a lacerated wound through the sphincter and both forward and backward into the perineum. This, I gather, from the patient's description of the injury and from subsequent examinations in the hospital, was what took place originally. The loss of blood was sufficient to weaken him, although he continued his journey on a cattle train, and reached

Chicago some hours after he was injured. He states that two operations were performed for his relief in Chicago, two subsequently in Boston, and two in New York, from only one of which he experienced any relief. The operation, performed in New York, and which he states consisted in "twisting the lower part of the rectum and stitching it fast in its twisted position," gave him some relief, excepting when he was suffering from attacks of diarrhoea. At the time I first saw him he was thin, pale, slept badly, and was generally a nervous wreck. He was suffering from no organic disease, but used alcohol to excess. His physical and nervous condition was, he states, entirely due to the injury to his rectum. He was in a filthy condition due to the frequent faecal discharges. Examination showed short but firm scars, extending one forward and one backward and to the left from the sphincter, which manifested no contractile power whatever on the finger inserted into the rectum. Nor could the patient by any voluntary effort cause it to contract to the slightest degree. With such a history, and after failure to secure any material relief by skilfully performed operations, and suffering in body and mind from disease that was incurable as far as furnishing the patient with a new sphincter and muscle was concerned, I was at a loss to know what to do that would benefit him and restore him to a condition that might enable him at least to earn his living with some degree of comfort. Inguinal colostomy or what may properly be described as anorectal transplantation were the only two things that suggested themselves to my mind as offering any material relief. While inguinal colostomy as at present performed is a comparatively safe operation, and the patient on whom it has been done is not in many cases an offensive companion, it involves the wearing and care of some form of mechanical obturator, and in this case, when my object was to restore him to active work, I doubted whether he could or would give the necessary attention to the apparatus to make it efficient, especially as he had objected to wearing any apparatus up to the time I saw him. I therefore resorted to the anorectal transplantation after fully explaining the operation and its experimental character, and getting his consent to its performance. After the usual preparations for a rectal operation, and with the patient under ether and on his side, an incision was made extending from about a quarter of an inch outside the anus following the natal cleft to

the sacrococcygeal articulation. The coccyx was removed, and the rectum, including its middle and lower third, freed from the surrounding soft parts posteriorly and laterally, and the hæmorrhage checked by torsion. The patient was then put in the lithotomy position, and with an assistant holding a sound in the urethra the anterior portion of the rectum was separated by means of scissors. In my anxiety to avoid opening the urethra, I accidentally opened the rectum about an inch above the anus. After freeing the anterior surface well up to Douglas's cul-de-sac, I sutured the small opening I had made into the rectum with two catgut sutures, and by means of fine black silk sutures anchored the anal end of the rectum in the upper angle of the wound in the skin just below the sacrum. The wound below the upturned rectum was then stitched after irrigation, and dressings applied and the patient put to bed.

The risks of such an operation as the one described above are not great, and many of them are the same as we encounter in excision of the lower two-thirds of the rectum for malignant disease. One must bear in mind the relation of the ureters and seminal vesicles to the rectum, the possibility of opening the peritoneal cavity, and secondary infection from septic disease in the perineum. The hæmorrhage in such a wide open wound is easily controlled by ligation or, still better, by torsion. There were in the case reported two things about which I felt some uncertainty and anxiety; first, the effect on the blood supply of the rectum from cutting off so much of its blood supply by the free dissection that was necessary, and from the very acute angle that was made in the posterior wall by folding it back on itself in order to place the anus in the upper angle of the wound; and, second, what effect traction on the bladder by the anterior wall might have in producing irritation of the bladder. Fortunately, any anxiety that was felt immediately after the operation soon proved groundless, for the mucous membrane kept its color, there was no gangrene or ulceration at that point, and there was not the slightest bladder irritation.

What was accomplished, then, was an anorectal trans-

plantation, quite unlike an artificial anus, in the same location where the rectum has been partially excised, and where the contents of the bowel make their way out straight through the upper part of the rectum. In this patient there was a rectal pouch, the bottom of which was about three inches below the transplanted anus, and the posterior wall of the rectum was folded back on itself and formed a thick valve just inside the anus. Fæces must therefore reach the bottom of this pouch, and by reverse motion travel back about three inches, with no peristalsis in the transplanted rectum to aid the motion (for this portion of the rectum was already paralyzed), and finally pass this valve, made by the posterior wall of the rectum, before it could be evacuated. In addition to this, the presence of fæcal matter, which in a healthy rectum produces a desire for its expulsion, produced no such desire in this case, for the rectal sensitiveness had been almost abolished by the original injury.

The patient complained a good deal of pain for three or four days following the operation, and there was infection of the perineal portion of the wound and suppuration for several weeks. There was at no time a fæcal fistula from the accidental wound in the rectum. From the time of the operation the patient began to experience the benefit that I had hoped for. He had several discharges from the bowels in the morning, but during the rest of the day and sometimes during the night no discharge occurred; and at the time he left the hospital, January 10, 1900, he had, as a rule, two evacuations in the early morning and none after that until the following morning. He was in the hospital fourteen weeks.

About two months after he left the hospital I saw and examined him. He had gained flesh, strength, and color and slept and ate well. The anal orifice was a vertical slit; the valve formed by the posterior wall of the rectum was still present and had not atrophied; there was no bladder irritation, and from digital examination I felt there would be none, for the pouch at the bottom of the rectal curve, instead of diminishing, had grown perceptibly larger. The bowels were

acting once or twice in the morning, and during the rest of the day he was comfortable. He said he was able and ready to resume work, and expressed himself well satisfied with the result of the operation. I think myself that I had gained all that might be reasonably expected from the operation. What the ultimate result is to be is, of course, uncertain. I feel now quite sure that the anus will not be displaced, and that the rectal pouch will not be obliterated by contraction. I should have more fear that it might become abnormally dilated. What will become of the rectal valve, I will not venture to predict.

It may be that in cases where paralysis of the sphincter ani is due to other than local causes, and when the patient is in condition to stand the operation, benefit might be derived from an anorectal transplantation. It would hardly be thought of in patients confined to bed; but it offers some chance of relief from a distressing symptom in those that are able to be up and about.

In a subsequent operation I should try to avoid opening the rectum, and should certainly leave the lower angle of the wound open for irrigation and drainage.

ACUTE INTESTINAL OBSTRUCTION FOLLOWING APPENDICITIS.

A REPORT OF THREE CASES SUCCESSFULLY OPERATED UPON.¹

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ACUTE appendicitis, with its coincident peritonitis of various degrees of severity, is probably a much more common cause of acute intestinal obstruction than is generally known or might be inferred from the comparatively small number of cases which have been recorded. That intestinal obstruction should occasionally follow as a sequence of acute appendicitis can readily be understood if we consider for a moment what takes place in practically every case in which the inflammation extends through the walls of the organ to the overlying and adjacent peritoneum. Why it should not oftener occur, indeed, in view of the extensive abscesses, the many late and incomplete operations, of the extensive and often unnecessary gauze packings which are used, is not so easily explained.

Although several cases of successful operation for obstruction following appendicitis have been shown and reported before this Society in the past few years, their number is not large; but, from conversations with different members and with various medical men, the writer is led to the belief that the condition has been rather more commonly observed than the figures would seem to indicate.

¹ Read at a meeting of the New York Surgical Society, May 8, 1901.

In view of the very great importance of the subject, and with the hope that his experience may add something to its clinical knowledge, the writer feels that no further apology is necessary in presenting this paper.

The relative frequency of acute intestinal obstruction as a sequence of acute appendicitis cannot, of course, be accurately estimated, nor is it essential that it should be, however valuable the knowledge might be from a statistical stand-point. From a study of the very valuable statistical paper of C. L. Gibson ("A Study of 1000 Operations for Acute Intestinal Obstruction and Gangrenous Hernia," *ANNALS OF SURGERY*, Vol. xxxii, Nos. 4 and 5), we find that obstruction by "bands" is the commonest form of acute obstruction in the adult; the term "band" being used in its broadest significance, so as to include all of the different kinks, twists, and constrictions due to inflammatory adhesions of the peritoneum. In this series of cases, Gibson found 186 of them to have been due to "bands," of which 58 per cent. were in males; a fact rather suggestive from an etiological stand-point, and the site of the obstruction to have been the small intestine in 86 per cent. of all the cases.

From an examination of the records of the Transactions of the New York Surgical Society, as reported in the *ANNALS OF SURGERY* since 1893, I have been able to find reports of but twenty cases. The first of these was presented by Dr. Abbe¹ at the meeting of February 4, 1894. It was the case of a boy of twelve, who had developed symptoms of acute obstruction about one week after an operation for acute appendicitis. The secondary operation had been done after fæcal vomiting had been present for three days, and the cause was found to be due to a kink in a coil of small intestine which had become adherent at the old appendical site. Recovery followed.

In the discussion following, Dr. Briddon² reported a case in which marked obstructive symptoms had developed about two weeks after an operation for appendicitis, and which had yielded to vigorous abdominal massage under chloroform while the patient was held up by his heels.

Dr. Wyeth³ then reported a case in which, for the relief of a similar obstruction, he had made an artificial anus with immediate relief of the symptoms.

Dr. F. H. Markoe⁴ reported a case of acute obstruction occurring in the course of an acute appendicitis, in which the obstruction was due to an adhesion between a perforated and inflamed appendix and a coil of small intestine which had become acutely angulated. The case died from an extension of the already existing peritonitis.

On February 8, 1894, Dr. Gerster⁵ showed a case for which a successful operation had been done two and a half weeks after the primary one for an acute appendicitis. In this case the belly was reopened by an extension of the old incision in both directions, and the seat of obstruction had been found upon the left side of the cavity and in a coil of small gut, which was surrounded and occluded by a fine fibrous band which stretched around it from one side of the mesentery to the other.

At another meeting, April 26, 1896, Dr. Lange⁶ showed a case, twenty-two years old, which had developed ileus four weeks after an operation for suppurative appendicitis and in which the cause of obstruction was also a "band."

Dr. Lange stated that he had operated six times altogether for similar conditions, with three recoveries.

In March, 1900, Dr. Johnson⁷ showed a case in which a very late operation had been done for an acute obstruction due to a fibrous band, in which the symptoms had developed immediately after an operation for appendicitis.

Dr. Lilienthal,⁸ at the same meeting, reported three cases all recovered.

At the meeting of April 11, 1900, Dr. Willy Meyer⁹ read a paper on "Rare Complications after Operations for Appendicitis," in the course of which he reports at length three cases of acute obstruction with two recoveries. In two of the cases the complication had developed early, but in the third not until nearly a year had elapsed. In the discussion of the paper, Dr. Johnson reported a case in which two operations

had been required within the year following the original operation for appendicitis, and in which death had followed a third attempt to relieve an obstruction which had developed in the course of the second year.

Dr. Coley also reported a case operated upon by another surgeon in which a loop of strangulated gut had been excised, as a result of which a fistula had formed, and for the relief of which he had operated three years later.

This list comprises briefly all the cases which I have been able to find in the records of the New York Surgical Society for the past eight years. With the hope that others may be induced to relate their experience in these perplexing and often very difficult cases, and that the deductions which the writer has arrived at from his own experience may be freely criticised, the histories of the following cases are submitted.

CASE I.—Acute Perforative Appendicitis; Secondary Acute Intestinal Obstruction Sixteen Days later; Secondary Laparotomy; Recovery.—Male; single; aged twenty-six years; seen first in consultation, February 6, 1901.

The following is a brief outline of the history as given me by his attending physician. About a week before the patient had been seized with abdominal pain of a colicky character, which in the next few days grew more severe, but not localized and not accompanied by tenderness except around the region of the umbilicus. Three days later, he had been seized with a violent chill and extreme general abdominal pain, and later vomiting. On the following day the pain had become more marked over the lower abdomen, with a tendency to right-sided localization. A few hours before my first visit, tympanites had developed, and the patient's condition had become very alarming. At the time of the first examination his condition was most unpromising. His face was drawn and pinched, his eyes deeply sunken, his skin cool, clammy, and slightly cyanotic, and the abdomen was distended and generally tender. Immediate operation was advised and accepted, and the case was transferred at once to the hospital, and operated upon as soon as preparations could be made. His temperature at this time was 99.4° F.; pulse, 84; respirations, 40.

Operation.—Ether; lor.g, oblique, right-sided incision. When

the peritoneum was opened a considerable quantity of yellowish, foul-smelling, thin, purulent fluid escaped, and the lower part of the abdomen and pelvis seemed to be filled with the same as far as could be seen. The appendix was long and lying to the inner side of the cæcum; it was angulated acutely, gangrenous in its distal portion, which contained two faecal concretions, and perforated. It was excised, and the stump turned in with purse-string suture. The intestines were congested, distended, and covered here and there with small patches of fibrin. As there were apparently no limiting adhesions, and free pus was rather widely distributed, the whole field about the appendix and the cavity of the pelvis was washed out with hydrogen peroxide solution, and flushed immediately after and repeatedly with hot normal saline solution poured in from a pitcher until the fluid came away clear.

The abdominal wound was then closed; two wicks of sterile gauze surrounded with wet rubber tissue to prevent their sticking to the intestines having first been introduced; one extending to the bottom of the pelvis, the other to the old appendical site. At the close of the operation the patient was in profound shock, but rallied in response to repeated infusions of hot salt solution and strychnine. The rectal tube was used freely during the night and gave some relief. The next day there was still some tympanites, although gas and a small fluid movement had followed a high enema. There was free drainage of serous fluid without odor along the wicks. Calomel and salts in saturated solution were begun. The next day the patient vomited a large amount of yellowish, faecal-smelling fluid, although his general condition had improved. His stomach was washed out, and following this a high enema brought away some gas and faeces and gave relief. The gauze wicks were removed on the next day. The distention, gradually diminishing, continued for a few days more, but by means of repeated enemata the bowels were moved and the patient, gaining in strength each day, was kept comfortable. He went on after the first week to an apparently normal convalescence, and was taking and digesting solid food without distress. On February 21, or sixteen days after the operation, and after eating rather generously of fruit which his friend had brought in to him, he began to complain of severe abdominal pain of a crampy character, and later vomited twice. His temperature was not elevated. The attack was at first looked upon as one of acute

indigestion, and he was treated with calomel and enemata, which at first brought away a small constipated movement and afforded him some relief for a time, though vomiting began again a few hours later. On the 24th the patient, who had up to this time not seemed very sick, suddenly began to appear so. There was now absolutely no response to repeated enemata; his abdomen began to be distended, and he vomited considerable brownish fluid with a faecal odor. The diagnosis of complete intestinal obstruction was now clearly evident, and immediate operation was advised and done.

Operation.—Ether; median laparotomy. The stomach having been washed out, the edges of the old operation wound, which was granulating, were freshened and brought together by suture, and sealed with an aristol, cotton, collodion dressing. A median incision below the umbilicus was then made, and the belly opened. Free serous fluid escaped on incising the peritoneum; several coils of distended gut protruded through the opening and were caught and protected by hot, wet saline towels in the usual manner. The obstruction was found quickly and without much difficulty. It was caused by a thin band from the right free edge of the great omentum, which had become adherent in the region of the old appendical site in such a manner as to tightly compress a loop of ileum which passed beneath it. The band was divided and the gut released. No further points of obstruction were found after careful search, although numerous adhesions between adjacent coils of small gut were broken up and points of possible angulation straightened out. The peritoneal cavity was flushed with hot saline solutions, of which a large quantity was allowed to remain; the omentum carefully drawn over the intestines, which had been carefully replaced, and the abdominal wound was closed with tier sutures, without drainage. During the night the patient passed large quantities of gas, and had several involuntary movements of thin, brown fluid faeces. The day following he had several enormous movements, and went on to a perfectly smooth convalescence. The sutures were removed on March 1, and the patient went home well on the 10th.

CASE II.—*Acute Appendicitis; Progredient Fibrino-purulent Peritonitis; Secondary Acute Obstruction of the Bowels on the Ninth Day; Secondary Laparotomy, Tenth Day; Faecal Fistula; Recovery.*—Male; aged fourteen years; seen April 4, 1901,

on the fifth day of a first attack of acute appendicitis. The seizure had been somewhat atypical in that the constipation, with very slight elevation of temperature, had been a marked feature, and the tenderness was not well localized. He had vomited for the first time, however, only a few hours before my visit, and had complained especially of intense abdominal pain, which was much more severe at times. Operation was urged at this time, but declined by the family until the following morning, when they allowed it, as the boy's condition was clearly desperate.

April 5, 1900. *Operation.*—Ether was administered, and the abdomen opened through a vertical incision separating the outer fibres of the right rectus muscle. The omentum was adherent to the parietal peritoneum, and, being freed, two or three small abscesses were found beneath it and between adherent coils of small intestine. These pus collections were mopped out with hydrogen peroxide, flushed clean with hot normal salt solution, and the adherent intestinal loops were freed. The appendix was found in one of these abscesses, lying well over towards the median line. It was gangrenous, perforated near the tip, and contained a faecal concretion. It was removed, and the stump ligated with fine chromic gut. The whole field about the appendix was washed out with hydrogen peroxide, followed by hot normal salt solution, and the wound partly closed. Wicks of sterile gauze wrapped in rubber tissue were used as drains. During and at the close of the operation the patient's condition was very bad, and it was necessary to resort to subcutaneous infusion of large quantities of hot salt solution to prevent utter collapse. The patient rallied slowly, but the next day, as he had vomited some and had had no response from an enema, his stomach was washed out, and a half-ounce of Epsom salts in saturated solution was left behind. This was followed later by a large enema of ox-gall; as a result of which he had a small movement and expelled much gas. His condition immediately began to improve, and he went on apparently to a normal convalescence, although there was some wound infection, which necessitated the removal of all sutures. This, however, all cleared up, the wound was granulating nicely, and there was every prospect of a speedy recovery, when on April 15, or nine days after the original operation, he began to complain of rather severe abdominal pain. The next day his physician, Dr. Greanelle, notified me by telephone that the patient

was worse, and had had no movement in spite of repeated enemata. Profiting by my experience in the former case, immediate operation was advised and done.

Operation.—Ether; median laparotomy, assisted by Dr. Greanelle, April 15, 1900.—Upon opening the peritoneum, the intestines were found to be matted together in places by soft, fibrinous adhesions and much congested and distended. A widely distended coil of small gut was selected and followed until the point of obstruction was reached. This was a kink in an adherent coil of small intestine which had completely obliterated its lumen. Its release was followed by the flow of gas and fluids into the collapsed portion below. On searching further for any additional point of constriction, numerous adhesions between adherent coils of gut were broken up, and in freeing one adherent coil low down towards the left side of the pelvis a large abscess was opened into and a great quantity of stinking pus gushed out, soiling the field widely. The pelvis and lower portion of the peritoneal cavity were then washed out with hydrogen peroxide solution and flushed repeatedly with hot normal salt solution until it returned clear. The wound was loosely sutured, and a drainage-wick of gauze wrapped in rubber tissue was introduced into the old abscess cavity. The operation had to be rapidly done, as the patient's condition was very poor and he required salt infusions and free stimulation to allow us to complete it. The patient slowly rallied from the shock, and his condition had decidedly improved the next day and his temperature was lower. On April 17, two days after the date of operation, the removal of the drainage-wick was followed by a free discharge of fæces, apparently from the sigmoid flexure, which had probably formed one of the walls of the large abscess which was opened into at the operation. The wound was well washed out, all sutures were removed, and a large rubber tube was inserted and left for two or three days. The temperature fell, and the patient, though very weak, began to improve. A movement was secured by the natural passage after a little while in response to daily enemata; and, although fæces continued to come through the fistula for many weeks, the quantity slowly diminished, the wound granulated up solidly, and the fistula finally closed. The boy reported at my office in July strong and well, the abdominal wound soundly healed, and no hernia.

CASE III.—*Acute Suppurative Appendicitis; Secondary Obstruction Two Weeks later; Operation on Sixth Day; Fistula of Small Intestine; Third Operation for Resection of Gut and End-to-end Suture; Recovery.*—Male, aged twenty-four years; seen first on October 20 at the beginning of the sixth day of an obstruction of the bowels which followed an operation for acute suppurative appendicitis on October 1, 1900. The chief points in the history of the case are as follows:

After the operation the patient had suffered very much for several days from gaseous distention of the bowels and from vomiting and constipation, which had, however, finally yielded to treatment. After this the patient was quite comfortable, the wound was healing nicely by granulation, and the patient had so far progressed towards recovery that he was allowed to sit up in bed. On October 15, a little over two weeks from the time of the original operation, and after a very hearty meal, he complained of severe abdominal pain, gaseous distention of the bowels, and began to vomit. The physician in attendance, thinking the attack one of acute indigestion, administered calomel and gave morphia for the relief of the pain. There was no response from the calomel, and repeated enemata yielded but small results in the shape of some gas and a little discoloration in the returned injection for the first two or three days. The patient continued to vomit and suffer from distention of the bowels, being relieved slightly from time to time by the passage of some gas following an enema. It was necessary to administer opiates quite freely, however, to give the patient any real relief. On the 18th he was seen by another surgeon, who counselled further waiting until the effect of high enemata should be demonstrated. As his condition continued to grow worse and the patient was clearly losing ground, I was called upon to operate and take charge of the case.

At this time, *i.e.*, after five days of more or less complete intestinal obstruction, his condition was most unpromising. He had frequent vomiting. His abdomen was so distended that respiration and heart action were considerably embarrassed. He was very restless, and had paroxysms of severe colicky pain from time to time, during which the exaggerated peristalsis of the distended intestinal coils was distinctly visible through the tightly

stretched abdominal wall. The distention was most marked, however, in the upper segment of the abdomen, and the visible peristalsis was here most remarkable.

In this case every detail essential to the completion of the picture of a classical case of acute intestinal obstruction was present. Immediate operation was done.

Operation.—Ether; median laparotomy. Dr. Williams assisting, Dr. Gleason giving the anæsthetic. The stomach was first thoroughly washed out before the anæsthetic was given. After the patient was anæsthetized, the original wound was cleaned and scraped out, and the edges were approximated as closely as the distended condition of the abdomen would permit. It was then covered by a pad of gauze which was intended to exclude it from the field of operation. After careful disinfection of the skin, a median incision below the umbilicus was made and the peritoneum opened. As soon as this was done, coils of enormously distended intestines burst out through the wound, together with a considerable quantity of clear serous fluid. A brief attempt to find the point of obstruction revealed the fact that the intestines were so distended that the peritoneal coat actually cracked on manipulation in one or two places, and the whole mass was so bulky and unmanageable that it was impossible to properly deal with it and at the same time find and deal with the cause of obstruction. Hastily selecting a much distended coil of small gut and drawing it out to the full limit of its mesentery, an incision was made into its lumen, which liberated an immense amount of fluid and gas. The incision was then closed by a running Lembert suture and the intestine washed and replaced. A second incision was then made in a neighboring coil, and further escape of gas and fluids encouraged, which not only allowed the mass of intestinal coils to be easily handled without further damage, and the point of obstruction to be easily found and dealt with, but also relieved the distended, congested, and partially paralyzed intestines from their load of stagnant contents. Although some relief to the heart and respiration followed at once upon the opening of the peritoneal cavity, the relief which followed the incision into the intestines was most striking, and was at once noticed by the anæsthetizer, and commented upon. The site of obstruction was in the lower ileum, and the cause was a rather thick fibrinous band which stretched from the neighborhood of the old appendical

abscess and tightly bound down a coil of ileum, completely obstructing its lumen. This was divided, cut away, and the gut released. The collapsed portion below filled up, and although search was made, no other points of obstruction were found, though numerous points of angulation due to adhesions were broken up. The loop of gut which had been compressed showed distinctly the mark of the constricting band, and, although it was not gangrenous, its vitality was evidently somewhat impaired. Under douches of hot salt solution, however, it seemed to revive, and, in view of the desperate condition of the patient, it was deemed better to leave the coil beneath the wound rather than attempt a resection which under the conditions would surely have been fatal. There were one or two other points in the wall of the small intestine where subperitoneal hæmorrhages had occurred, and the wall of the gut at the points where the peritoneum had torn was too friable to permit of easy suture, which was attempted and abandoned. The suspicious points were therefore rubbed with aristol powder, and left. The peritoneal cavity having been repeatedly flushed with hot normal saline solution, and a considerable quantity left behind, the abdominal wound was loosely closed with the damaged coil of ileum lying directly beneath it. During the operation, large quantities of hot normal salt solution were infused into the subcutaneous tissues of the chest, and at the end a large hot saline enema was given. The patient was put to bed in considerable shock after the operation, which was difficult and necessarily prolonged, although the work was done as rapidly as the conditions would permit. He rallied quickly and satisfactorily from the shock, however, and had a fairly comfortable night, during which he expelled considerable quantities of gas per rectum, and expressed himself as being much relieved. The rectal tube was used at frequent intervals and each time with relief. He slept in short naps, awaking once in a while and complaining of cramp-like abdominal pains. Early the next morning a bottle of citrate of magnesia was given in divided doses and retained. At 11 A.M. he vomited and his stomach was thoroughly washed out. There still remained some abdominal distention, and he complained occasionally of pain and a feeling of distention with gas. At 3 P.M. his condition was not at all promising; he felt nauseated and had vomited; his expression was bad and his pulse very rapid and feeble. His stomach was

again washed out and a half-ounce of saturated solution of Epsom salts introduced through the tube and left. After allowing him to rest after this procedure, which exhausted him somewhat, a large ox-gall enema was given through the high rectal tube, and this was followed by the escape of a large amount of gas from the bowel, and gave such great relief that he fell asleep, and awoke in about two hours feeling much refreshed and looking much better. At 7 P.M. he had a small brown watery stool and another an hour later. After drinking a cup of hot tea at 8.30 P.M. he vomited, and in the vomitus were particles of undigested appleskins which had been eaten a week before. Later he had another movement and passed much gas. About three hours later he vomited a large quantity of bile-stained fluid, and expelled a great deal of gas through the mouth, which furnished him considerable relief. The rectal tube brought away considerable gas and some feces, and after this the night was a fairly comfortable one, although the patient was drenched with perspiration. The next morning he was much improved, and said he felt hungry; but, as he was slightly nauseated, the stomach-tube was passed and the viscus washed out for the last time. Later, an ox-gall enema brought away a large, partly formed stool and gave him relief. After this the patient's condition steadily improved, and the abdomen, under the influence of occasional enemata, became soft and flat, and his food, largely fluid at first, was well retained, and he gained strength steadily. During the first forty-eight hours after the operation, enormous quantities of urine were passed, the perspiration was very profuse, and the odor of ether disappeared entirely in a few hours both from the breath and the secretions. This was due to the large quantity of normal saline solution which had been thrown into the circulation during the operation. After this the improvement was rapid and continuous, and all pain and distention disappeared. The patient took and digested semisolid food, and had one or more movements every day.

Eight days after the operation, however, the wound, which had been normal in appearance, showed some signs of infection, opened, and began to discharge a fluid which at first seemed purulent, but a little later presented the character of small intestinal contents. This discharge soon became very free, and its irritant qualities decidedly evident on the skin edges of the wound,

which later became raw and exceedingly tender. The assiduous attention of his devoted and intelligent nurses, which never failed during the many days of pain and discomfort which followed, alone served to make his condition at all tolerable, and the writer feels that to their careful, faithful, and constant care much of the success in the final outcome of the case is due.

On November 1, as a result of a temporary plugging of the intestinal fistula, a very sharp and well-nigh fatal attack of acute obstruction supervened, which, however, was spontaneously relieved, after a few hours, by the discharge of enormous quantities of fluid which burst out of the opening and brought relief at a time when he was thought to be dying. Upon my arrival about an hour afterwards, the patient, though much exhausted, was quite comfortable and soon fell asleep. The fistulous opening was somewhat enlarged and kept carefully open after this experience, and there was no further trouble except such as resulted from the irritant character of the intestinal discharge upon the skin of the abdomen. After this, very careful attention had to be given to the feeding of the patient, which, of course, was highly important, in view of the fact that hunger was more or less constantly present by reason of the short circuiting of the major portion of the small intestinal contents out through the fistulous opening. A small stool was passed each day, however, in response to an enema; and his nutrition steadily improved, especially when it became possible for the patient to secure long hours of refreshing sleep at night without the necessity of being disturbed for a change of dressings. It was found that the discharge of intestinal contents through the fistula was most copious and continuous after meals, and, by giving him his heaviest and largest meals in the middle of the day and a light supper at night, the discharge in the evening hours was less copious and disturbing. Finally, it became possible to plug the fistula for several hours at night and allow the patient often eight or more hours of unbroken sleep. He gained daily in strength and considerably also in flesh under this régime. As it became apparent from the nature of the fistula that it could never close spontaneously, and as the patient felt that he was willing to submit to the risk of an operation for its relief, in view of his much improved condition, the operation was done on November 25.

Operation.—Intestinal resection, and end-to-end anastomosis

by suture. The night before the operation a very light meal was given in order to secure an empty condition of the gut on the following morning, and this measure proved thoroughly efficacious. The patient was prepared in the usual manner, and a hot saline enema containing an ounce of whiskey was given before he was etherized. After he was placed upon the operating table, the operative field was carefully disinfected, a proceeding which required considerable time on account of the condition of the skin near the edges of the fistula. A broad strip of cracked and infiltrated skin on either side of the fistulous opening was excised, and the peritoneum then opened. The fistula, a mucocutaneous one, was too wide to admit of closure by suture, and the only alternative was resection of the gut and joining together of the divided ends. This was done in the following manner:

The loop of small intestine, sharply angulated and tightly adherent, was carefully freed, and a resection of several inches of gut, wide of the fistula, was made. The divided ends were then united with sutures of silk in the usual manner, especial care being given to the adjustment at the mesenteric borders. In order to determine whether the sutures were competent or not, I had recourse to a measure which, while probably not original, was certainly born of the emergency. Holding the intestine at a distance above and below the point of suture, I was enabled to apply the hydrostatic pressure test most effectively by using the saline-infusion needle, which was withdrawn from the subcutaneous tissue of the thorax, thrust into the lumen of the intestine, and held there until a sufficient pressure of water enabled me to demonstrate the strength of the suture line, upon the integrity of which the fate of the patient depended. One or two small leaks having been shown, they were sutured, the hydrostatic test was again applied, and the small hole made by the needle puncture closed by a Lembert suture. The intestines in the neighborhood were carefully examined, and the two points where the intestine had been incised at the previous operation were identified by the black silk sutures still in place. Numerous adhesions which might cause angulation of the gut were broken up, the intestines were straightened out to some extent, the peritoneal cavity filled with hot normal salt solution, the omentum carefully drawn down in front of the intestines, and the abdominal wound closed without drainage by tier suture. The lower end

of the skin incision, on account of the extensive excision around the edges of the fistula, could not be brought together, and the space left open filled in by granulation.

The operation was a long and difficult one, and it was necessary to infuse the patient freely with the hot normal saline solution. He was put to bed in moderate shock, from which he quickly rallied. Morphia in small doses was given for the next few days, and he was fed entirely by the rectum for a week. Feeding by the stomach was cautiously resumed, December 2, and from that time on his convalescence was steady and uneventful. On December 15 he was allowed to sit up, and he went on to perfect recovery, the wound healing firmly, and no hernia has so far developed (July, 1901).

The diagnosis of acute intestinal obstruction following appendicitis is often perfectly simple; especially as the complication generally arises within two or three weeks of the primary operation, and often after all temperature elevation and other signs of inflammation have subsided. As the obstruction is almost invariably in the small intestine, and often more or less complete from the first, the symptoms are apt to be acute, the onset sudden, and fæcal vomiting to occur early.

The diagnosis, unfortunately, is not always so easy; as, for example, in cases where obstructive symptoms arise immediately after an operation, or in cases developing a few days later, when there is still some elevation of temperature. In these instances it may not be at once possible to determine whether the condition is one of postoperative ileus, which may yield to gastric lavage, salines, and the high enemata, or one of progressive generalizing peritonitis, or a mechanical obstruction of the bowel. In some cases, indeed, there is a combination of pathological conditions which only an exploratory laparotomy will make clear.

The writer feels no hesitancy, in view of his own experience, in urging the immediate reopening of the abdomen, through the median incision rather than by an extension of the old wound, in any cases of doubt. The reluctance of surgeons to reopen the abdomen is so well known that any reference to

it here may seem unnecessary; but the writer feels that it is a factor which has to be dealt with in every case, and which requires the strongest courage of one's convictions to overcome both in one's self and in others.

Many surgeons have reopened the abdomen in cases with symptoms of obstruction only to find a general peritonitis present; and the results have made most of us sceptical as to the value of the procedure, while others, after many disappointments, condemn it outright as useless. That true mechanical obstruction may coexist with a progredient fibrinopurulent peritonitis however, and both conditions be amenable to proper surgical treatment, cannot, of course, be denied in view of the published cases. The second of my series offers, I think, an excellent example, as does one of the cases reported by Willy Meyer in the paper already referred to.

In any case where the diagnosis of acute obstruction of the bowel is reasonably sure, and, as has been pointed out, this in most cases is not difficult, no time should be lost in operating and relieving the cause of obstruction. The practice of waiting for faecal vomiting in these cases is only mentioned to be condemned. Curiously, it is not always the medical brother who wishes to delay the operation, but sometimes the surgeon himself, who ought to know better.

It is perhaps the cases of partial obstruction, and those which are at first partial and then complete, which give rise to most delay, and lead us to persist too long with enemata when the indication is clearly for operation.

It is evident that the prognosis in cases of acute intestinal obstruction following appendicitis depends upon various factors other than the seat of the obstruction and its duration, and upon none more, perhaps, than its early recognition and early operation.

Cases early recognized and promptly relieved by operation give almost uniformly good results, since, in the early operative cases, the obstruction alone has to be found and relieved, generally an easy matter; while in the late cases much more complicated procedures are often necessary. For in these the

surgeon must not only be prepared to relieve the obstruction,—often a very difficult matter,—but also to deal with the various complications which may exist by reason of changes which have occurred in the walls and contents of the affected intestines.

Briefly reviewing the three cases which form the basis of this paper, and which have been reported somewhat at length, the writer feels that he has shown the great value of certain procedures under given conditions.

First, the great utility as well as necessity for the free use of the decinormal salt solution, whether into the subcutaneous tissues, the rectum, or the veins, both during as well as after operation, as a guard against extreme shock. The condition of depression in at least two of the cases was so extreme that the writer feels the patients could not have survived the operation without its free, or rather its almost continuous, use throughout.

Second, the great value of free incision into over-distended coils of gut (*a*) in order to relieve upward pressure upon the diaphragm, and the disturbance of respiration and circulation consequent upon it; (*b*) to relieve the congested intestinal vessels, and to diminish the size of the enormously distended coils so that they may be handled without injury, and the obstruction more easily located and dealt with, as well as at the same time to drain away from the interior of the gut a great quantity of stagnant fluid before it can reach the absorbing surfaces of the intestine below the obstruction.

Third, the practicability and desirability of closing the abdominal wound without attempting to drain the peritoneum, and the leaving within the cavity sufficient saline solution to float the intestines and assist, perhaps, in their rearrangement.

The postoperative treatment of these cases, especially if they have been brought late to operation, is of vital importance, and upon its intelligent and diligent application the patient's fate depends.

The three measures which are essential are simple but generally effective. They are:

First, the persistent and intelligent use of the stomach-tube, with lavage.

Second, the early and, if necessary, the repeated administration of saline purges in concentrated solution, and introduced through the stomach-tube if retained no other way.

Third, the use of the rectal tube for the relief of gas, and the patient and persistent use of high enemata.

These three measures intelligently, patiently, and perseveringly employed, together with absolute abstention from the use of morphia, no matter what the temptations may be to use it, constitute the tripod upon which rational and effective treatment is based, and upon the intelligent use of which the life of the patient often absolutely depends.

REFERENCES.

- ¹ Abbe, *ANNALS OF SURGERY*, Vol. xix, p. 677.
- ² Briddon, *ANNALS OF SURGERY*, Vol. xix, p. 677, et seq.
- ³ Wyeth, *ANNALS OF SURGERY*, Vol. xix, et seq.
- ⁴ Markoe, *ANNALS OF SURGERY*, Vol. xix, et seq.
- ⁵ Gerster, *ANNALS OF SURGERY*, Vol. xix, p. 682.
- ⁶ Lange, *ANNALS OF SURGERY*, Vol. xxiv, p. 376, et seq.
- ⁷ Johnson, *ANNALS OF SURGERY*, Vol. xxxii, p. 293.
- ⁸ Lilienthal, *ANNALS OF SURGERY*, Vol. xxxii, p. 293, et seq.
- ⁹ Willy Meyer, *ANNALS OF SURGERY*, May, 1901, Vol. xxxiii, No. 5.

FOREIGN BODIES ACCIDENTALLY LEFT IN THE ABDOMINAL CAVITY.

WITH REPORT OF ONE HUNDRED AND FIFTY-FIVE CASES.¹

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(Concluded from page 522.)

NEUGEBAUER'S COLLECTION OF CASES.

THE following 101 cases have been translated from the article on "Foreign Bodies accidentally left in the Abdominal Cavity," by Franz Neugebauer, *Monatsschrift für Geburt. und Gynäkol.*

(1) A French physician, signed "Anonymous," cites in the "Revue des Maladies des Femmes," 1892, the following cases as examples of the great toleration of the abdominal cavity for foreign bodies. A patient, eight months after a myomotomy, passed, during a defecation, a twenty-six centimetres long gauze napkin four times doubled. Of this she had made complaint only since four months. The perforation of the napkin into the intestines was without any alarming symptom.

(2) A young lady suffering from salpingitis had a cœliotomy performed. Some time later a four times doubled thirty-five centimetres long gauze strip was extracted per vaginam. Soon after the same complaints again appeared. The abdomen was opened. In the attempt to loosen a loop of adherent intestine, one of the intestinal loops tore, and through the intestinal wall a large, long gauze strip was pulled. A ten centimetres long piece of intestine was resected, and the patient finally recovered after the two pieces of forgotten gauze strips had been removed.

Two extra operations had been performed, one of which, the hysterectomy, as it seemed, unnecessarily. After the last operation there remained for a long time an abscess, which finally healed.

(3) The same physician cites a case where immediately a second

¹ Read in abstract before the Louisville Surgical Society, June 10, 1901.

operation was performed and the abdomen opened to remove a forgotten pincette.

(4) The same physician cites a similar case of again opening the abdomen to remove a forgotten sponge.

(5) John Atlee, Sr., lost a patient the fifth day after the operation of ovariectomy. An autopsy was held, and a piece of sponge was found in the abdominal cavity. One of the assistants had torn one of the sponges in two pieces during the operation.

(6) Bode (*Centralblatt für Gynäkologie*, 1898, No. 18, page 277). In an abdominal section for tuberculosis a drain was employed in the lower angle of the abdominal wound. As the patient left the bed a few days later, the drain slipped into the abdominal cavity, and Bode had to open the abdomen a second time in order to remove it.

(7) Hermann J. Boldt ("Foreign Bodies accidentally left in the Abdominal Cavity during the Course of Cæliotomy," *American Gynecological and Obstetrical Journal*, 1898). Boldt had removed the uterus together with the appendages for carcinoma. Operation by the abdominal route. He inserted a gauze drain into the vagina. He ordered that the gauze drain be removed after the third day per vaginam, which was obeyed. The doctor inserted, without the knowledge of Boldt, another strip of gauze, and forgot to take it out. The patient left the hospital. The incision closed with a scar and the gauze remained within. Some weeks later the patient experienced severe abdominal pains and stubborn constipation. Finally, two months after the operation, the patient passed the forgotten piece of gauze and then recovered.

(8) Boldt (*Ibidem*) performed a hysterectomy by the abdominal method for fibroids, in the early part of 1897. The convalescence progressed very slowly. An abscess occurred accompanied by phlebitis. After the abscess had healed, the patient left the hospital, but was constantly troubled with pains between the epigastrium and umbilicus. In October, 1897, Boldt saw her again, and diagnosed a tumor that he held to be an inflamed loop of intestine. On the 3d of November he again resorted to an abdominal section, but, on account of a collapse of the patient, closed the wound. In consequence thereof there appeared a faecal fistula in the scar. In January, 1898, another abdominal section. The extended adhesions formed great obstacles to the operation, which was very complicated. The intestine was injured in five places. Suspicion was aroused on seeing one of the intestinal sections unusually thick and swollen. There was found in this intestinal section a piece of gauze embedded in faecal matter. The damaged intestinal section was resected; the exhausted patient died, however, after a few hours. In course of time this piece of gauze would no doubt have appeared spontaneously per anum, as it had already entered the intestine.

(9-13) Boldt further cites, out of the practice of his colleagues in New York, five cases never before published, where, after abdominal section, on post-mortem, foreign bodies were found that had been forgotten by the operators.

(14, 15) A pathologist of one of the hospitals in New York confessed

to Boldt that he had found, during autopsies following abdominal sections, at one time a pincette, and at another a sponge in the abdominal cavity.

(16, 17) Boldt further cites two cases of the immediate opening of the abdomen on account of a pincette being left in the abdomen in one case, and a sponge being left in the other.

(18) Borysowicz six years ago removed a subserous fibroid from a patient by the abdominal method. After three weeks the patient, in defecating, passed a gauze sponge that had accidentally been forgotten in the abdominal cavity.

(19) Gustav Braun found in a section after a laparotomy a pair of bulldog forceps in the abdominal cavity that had been forgotten.

(20) Karl von Braun found in a section after a laparotomy a sponge in the abdominal cavity that had been forgotten.

(21) Brosin (*Centralblatt für Gynäkologie*, 1898, No. 18) amputated a uterus bicornis with hæmatometra in one horn, and had, on account of the difficulty of stopping the profuse bleeding, to suture the stump in the abdominal wound. The wound healed in six months, after a piece of gauze twenty centimetres in length had escaped during the suppuration.

(22) W. T. Bull ("Report on Operative Surgery in New York Hospital," page 8). During a necropsy following cœliotomy a sponge was found in the abdominal cavity.

(23-27) Henry C. Coe (*The New York Polyclinic*, 1897) has found five cases where, in a necropsy after an abdominal section, a sponge was found in the abdominal cavity. Death by sepsis.

(28) Henry C. Coe also mentions a case where thirty-six hours after a vaginal hysterectomy a sponge was missed that seemed to have remained behind in the abdominal cavity. An incision was made, and after a long search the sponge was found under the liver.

(29) Cushing lost during an abdominal section a seal ring. After some years he again recovered the same through an incision in the fundus of the vagina.

(30) Dmochowski found in a section after a cœliotomy that was performed in the Infant Jesus Hospital in Warsaw a gauze napkin in the abdominal cavity.

(31) Elsner (Syracuse) (State Medical Society of New York, *American Gynecological and Obstetrical Journal*, 1895) describes the following cases. After an abdominal hysterectomy, the patient remained the same as before, suffering, and in course of time became constipated to such a degree that an ileus seemed evident. An operation was thought of, but on the passing of flatus the operation was postponed. That was in July. On November 26, the patient suddenly discharged a gauze tampon in an action six months after the operation. She was definitely relieved.

(32) George J. Engleman, of St. Louis, found in a section after an abdominal operation a sponge in the abdominal cavity.

(33) Hegar (Hegar und Kaltenbach, "Operative Gynäkologie," third edition, 1886, page 283) missed a sponge during an ovariectomy, and had to search over a quarter of an hour in the abdominal cavity before he finally found it encased in the mesenterium of the flexura sigmoidis.

(34) Herczel (Kongress der deutschen Gesellschaft für Chirurgie, siehe *La Semaine Médicale*, 1898, No. 17, page 132) mentions a case where a clamp remained a year and a half after an abdominal section, and only then began to create trouble.

(35) William T. Howard, Baltimore. After an operation performed by another surgeon, a sponge was found in the abdominal cavity at the autopsy. (See Wilson, L. C.)

(36) Howitz found during an autopsy a sponge that had been accidentally left in the abdominal cavity.

(37) Kader (*La Semaine Médicale*, 1898, No. 17, page 132). In the case of a patient whose recovery from cœliotomy was delayed, and who complained of pronounced constipation and attacks resembling ileus, a year later there appeared at the opening in the large intestine the tip of a gauze tampon, which was forthwith extracted. The patient was operated *in extremis* for ileus, and during the examination an extensive adhesion among the small intestines was noted. A large linear scar was observed, which evidently represented the place where the gauze compress had entered the abdominal cavity.

(38) Kosinski. See description detailed on page 513.

(39, 40) A. MacLaren ("Contribution to the Statistics of Foreign Bodies in the Peritoneal Cavity," *Gynecological Transactions*, 1896, xi, page 394; see Referat: "Revue de Gynécologie et de Chirurgie Abdominale," Tome i, 1897, p. 331) performed an ovariectomy with suspension. After the operation, the patient suffered much from constipation. An abdominal section was planned, when unexpectedly on the tenth day she had an action, and a gauze napkin was discharged that had entered the intestine, creating symptoms of a threatening ileus. In another case MacLaren performed a supravaginal amputation of the uterus on account of a large fibroid. From time to time the patient complained of fever and pains. Finally, after two years, MacLaren felt a hard, inflammatory infiltration on the right side, and opened the abdominal cavity. A hæmostatic forceps was found in the cæcum, the points of which had entered into the processus vermiformis. At this point the omentum was adherent to the cæcum. The cæcum was opened, the forceps removed, and the processus vermiformis resected. The patient had a smooth convalescence. MacLaren declares that he knows of seven more cases where a foreign body remained in the abdominal cavity and was discharged spontaneously per annum without endangering the life of the patient; but, as he does not cite which cases he refers to, I do not count them, as they may be the identical ones already mentioned by me.

(41-43) Leopold has himself observed three strange cases. In one case he noticed just before the closing of the abdominal wound that a clamp was missing, and immediately searched for it. It lay in the Douglas pouch. In another case he was compelled to reopen the abdominal cavity to search for a missing gauze compress, and found it on the right side of the liver. It had reached this location through a peristaltic wave. In the third case, during a symphyseotomy, a sponge slipped into the

prævesical space, and was not removed until twenty-one days after the operation.

(44) Lindquist (*Hygeia*, 1897, ii, p. 51). Two months after operation for a ruptured pregnant tube a forgotten gauze compress was discharged spontaneously per rectum. It had been left in the lower part of the abdomen.

(45) Michaux (*Société de Chirurgie*, April 13, 1892, p. 345. "Reperatoire Universel d'Obstetrique et de Gynécologie," 1892, p. 345. "Penetration dans l'intestine d'une meche de gaze iodoformée provenant d'un hysterectomie vaginale anterieure, laparotomie resection de l'intestine"). In September, 1891, an abdominal incision for diseased tubes was performed upon a young girl, a month later a vaginal hysterectomy. She still complained of trouble. On the left side of the pelvis appeared an inflammatory infiltration. An abdominal section was made, in which the intestine was injured and out of which a gauze compress was drawn. The intestine was resected.

(46) Morestin (*La Médecin Moderne*, 1898, No. 49, p. 388. Siehe Neugebauer's Referat, *Centralblatt für Gynäkologie*, "Martyrologie einer Operirten," 1898, No. 49, p. 1351). In August, 1894, an abdominal section was performed on a young woman twenty-nine years old for the removal of a double pyosalpinx and diseased adnexa. A few days after the operation an abscess appeared in the abdominal wall. There still remained a fistula that discharged when the patient, six weeks later, left the hospital. In December, 1894, the patient entered the surgical ward under the care of Dr. Le Dentu for the relief of a phlegmon in the left inguinal region. The abscess was opened and drained, everything going well. A new abscess formed in the cicatrix of the first operation. Pus burrowed and established a faecal fistula. La Dentu drained the pelvic abscess through the vagina. A general improvement followed, and the patient was sent to the country, only to be returned to the hospital a few days later. Urine now began to flow through the vagina. Evidently a communication had been established between the bladder and the abscess. After some time the urinary flow from the vagina spontaneously ceased. The patient left the hospital in August, 1896. In March, 1897, she again returned to the hospital, with urine flowing from the vagina. In April a new abscess in the right inguinal region was opened. Finally, the patient returned to the hospital, to declare she had at last recovered, since for six weeks all fistulas had closed. Fifteen days previously, during a movement, a pair of hæmostatic forceps, twelve centimetres in length, was passed. The forceps was very much rusted and black, as the result of wandering for four years in the abdominal cavity and intestines.

(47) Nussbaum forgot an artery-clamp in the abdominal cavity. It was found spontaneously in a defecation nine months after the operation.

(48) Nussbaum, according to Leopold (*Centralblatt für Gynäkologie*, 1898, No. 18), forgot a drainage tube in the abdominal cavity after an abdominal section. According to Olshausen, the patient herself, two months later, drew it out of an abdominal scar after spending the entire night in dancing.

(49) Olshausen (Hegar und Kaltenbach, "Operative Gynäkologie," iii, Auflage 1886, p. 283) mentions a case after an ovariectomy. A pincette was missed. Ten months later this foreign body was discharged spontaneously in a defecation after complaint had been made for two weeks.

(50) Olshausen (*Zeitschrift für Geburtshilfe und Gynäkologie*, xxv, Band ii, p. 539) found during an autopsy, four days after a Cesarean operation had been performed, a gauze napkin in the abdominal cavity that had been forgotten by the operator.

(51) Pilate (Orleans). "Expulsion par l'intestin d'une compresse ayant séjourné huit mois dans la cavité péritonéale," Société de Chirurgie, 1892, 23 Mars. ("Repertoire Universel d'Obstétrique et de Gynécologie," 1892, p. 227.) By an abdominal section, a myomatous uterus was removed from a patient forty-two years old. The operation passed smoothly. Later, pains were felt in the right side of the lower abdomen and the occurrence of phlebitis. The patient seemed to enjoy perfect health for six months, when there very suddenly appeared pains in the region of the liver. Abdominal pains, with vomiting which persisted for six weeks, reducing the patient to a critical state, when a gauze compress, enclosed in a mass of fecal matter, was passed by the anus, from which time all her symptoms disappeared and she rapidly recovered health.

(52) Quénu in the early part of 1891 forgot a compress in the abdominal cavity after an operation for an old pyosalpinx. Before the operation, the patient had been troubled with emphysema, mitral regurgitation, and hemiplegia. A severe collapse took place immediately after the abdomen was opened, so that artificial respiration had to be resorted to. During the excitement, the napkin must have disappeared in the abdominal cavity. For two days everything passed nicely, but on the third day the patient sank rapidly and died. During the autopsy the peritoneum was found smooth. The napkin was found at the same time wrapped around an intestinal section.

(53-55) Reeves Jackson describes three cases in which, after abdominal section, during an autopsy on one occasion, a pincette, and on two other occasions, a sponge were found in the abdominal cavity.

(56) Rehn (Frankfurt) ("Ueber bei Bauchschnitten in der Bauchhöhle vergessene Instrumenten und Verbandstoffe," XXVIII. Kongress der deutschen Gesellschaft für Chirurgie. Referat: *Monatsschrift für Geburtshilfe und Gynäkologie*, Mai, 1899, p. 684; auch, *La Semaine Médicale*, 1899, No. 17, p. 132) performed an abdominal section for ileus upon a patient on whom he had performed a former abdominal section for pyosalpinx and diffuse peritonitis. The narcosis was at that time so imperfect that the whole intestine was pressed out. The abdominal loop was wrapped in sterile compresses and thereby protected. The colon descendens was adherent to the pyosalpinx, which was removed in such a manner that a portion of the pus-tube was left on the intestine. After washing out the abdominal cavity with salt solution, the intestines were replaced and the Douglas pouch tamponed. The abdominal wound closed. Convalescence with the formation and the disappearance of fecal fistula. The patient was dismissed in good condition on December 9, 1897. The

patient was without complaint until the middle of April, 1898, when she suddenly, after partaking of red cabbage, experienced slight pains in the region of the stomach. Later, spasms accompanied the pains, at first not frequent, later every five minutes. The patient was removed to a hospital, where she begged to be operated upon, but without avail, whereupon she left and went to the city hospital, where she arrived on May 4, 1898. Tenderness was noticed in the epigastrium, together with a tumor in a transverse position measuring ten centimetres in length. This tumor seemed to have created the symptoms of an intestinal occlusion. Adhesions were suspected, because for three days neither faecal matter nor flatus was evacuated. An abdominal section was performed May 18, 1898. The intestine at one point was in a condition of partial gangrene, and the loop above the gangrenous area distended, while that below was empty. A section forty centimetres in length was excised. Adhesions of an ancient character, but without significance, were observed. The resected portion of the intestine contained a large mull compress. Recovery without further complication.

(57) P. Roesger ("Ein Beitrag zur Kasuistik Moderner Haftpflicht; Ansprüche an der Operateur," *Monatsschrift für Geburtshülfe und Gynäkologie*, 1898, Band vii, p. 331) performed an abdominal section upon an unmarried woman, aged forty-five years, for a large intramural myoma of the uterus as well as a myoma of the ligamentum latum. In consideration of climacteria all attention was directed to an oophorectomy. The operation passed smoothly, but a complication followed through the slipping of the ligature from an artery (*arteria spermatica interna*). The artery was immediately ligated. The toilette of the Douglas pouch was very difficult, as the myoma had changed the latter into a small canal invisible to the eye and only reached by the finger or split sponge. The sponges on holders were all present after the operation. After-course without fever. The stitches were removed on the twelfth day, and on the fourteenth day the patient was up, and returned home on the eighteenth day. Then followed a fistula in the abdominal scar. A probe was entered six centimetres in the direction of the abdominal wall and struck a ligature. In spite of the irrigation, pus continued. Roesger in October split the entire fistulous path, and found lying on the fascia a two-and-one-half-centimetres silk thread that must have been left there during the operation. The wounds healed, but there still remained a small fistula. The hysterical patient left the treatment of Dr. Roesger and consulted another physician, who some weeks after showed Dr. Roesger, to the latter's great astonishment, three pieces of sponge from pin-head size to the size of a mustard seed; these seemed to have been gradually washed out of the fistula. These discharges continued until September, 1894, after which the fistula closed. All the sponge particles taken together assumed the size of a peach-seed. The sponges had been prepared with kali hypermanganicum and sublimite; and it is easily understood that they became brittle from the process.

(58) Salin. "Bauchschnitt behufs Extraction eines bei der Koeliotomie in der Bauchhöhle vergessenen Gazestreifens" (*Hygeia*, 1891, p. 251;

siehe Referat, "Repertoire Universel d'Obstetrique et de Gynécologie," 1893, p. 34). In Stockholm, on the 31st of October, 1890, an ovariectomy was performed upon a patient aged fifty-five years. On this occasion a gauze napkin was left behind in the abdominal cavity. On the 30th of December the patient left for home. On the 21st of November, 1891, more than a year after the operation, the patient noticed an abscess forming in the abdominal scar. This abscess burst, discharging a profuse quantity of bad-smelling pus, after which, on the 25th of November, 1891, a gauze napkin was pulled out of the fistulous opening. The wound was washed and drained, and upon the next day pus escaped out of the fistula, after which the wound became smaller from day to day, and finally healed.

(59) Schramm (Dresden) (*Centralblatt für Gynäkologie*, 1898, No. 18, p. 277) operated upon a young girl of the working class, aged eighteen years, for pyosalpinx duplex; as some difficulty was experienced in the vaginal extirpation of the tubes, the uterus was also removed. During this operation an assistant held the intestines up by means of a tampon in a holder. The tampon slipped out of the holder and could not be found, and in consequence thereof the vaginoperitoneal wound was left open, expecting the tampon to escape. The expectation was not realized, and the patient was up on the eighteenth day and left the institution eight weeks after. On examining the patient before leaving, a retrovesical tumor, the size of a fist, was felt, immovable and without pain. He hopes that the foreign body will escape in some way sooner or later.

(60) Schroeder, in a Therapeutic Congress at Bonn, November 11, 1898, exhibited a specimen which had been removed by an abdominal section. About a year and a half previously he performed an oophorectomy on the right side, with ventrofixation of the uterus. On primary union of the abdominal incision after the operation the patient still complained of pain in the right ovarian region. These pains increased in intensity, and were practically unbearable during the act of defecation. On bimanual examination a tumor was noticed to the right and above the movable uterus. The tumor was painful to touch, was fluctuating, and of the shape of an egg. An abdominal section revealed adherent omentum and a tumor connected with the intestinal tract. In endeavoring to separate this tumor, the intestine was torn and discharged considerable pus. Closer examination revealed that the trouble was caused by a gauze sponge that had remained behind in a previous operation.

(61) Severeano (*Presa Medica Romana*, 8, iii, 1896; siehe *L'Indépendance Médicale*, 15, iv, 1896, p. 126). After an operation for ovarian sarcoma the wound refused to heal. Notwithstanding the absence of fever, there still remained a stubborn fistula. After laminaria dilatation of the fistulous path, the operator discovered a string in the fistulous opening, and pulled out a gauze compress one hundred and thirty centimetres long and thirty centimetres broad. Twenty-two days later he again drew out of the same fistula another gauze compress the size of the previous one. Fortunately, the pus contained no virulent organisms.

(62-64) Spencer Wells had three cases. He does not care to speak

of one of these cases, since it is still unexplained to him. One month after an ovariectomy an artery-clamp was found in the bladder (Case No. 917). In a second case, the assistant explained to him that a sponge had remained in the abdominal cavity; he, however, did not find the missing sponge, and the wound was closed. Six hours afterwards the nurse sent for Spencer Wells, and declared that a sponge was missing, and no doubt had remained behind in the abdominal cavity. What was he to do? Spencer Wells concluded to wait, as the patient seemed to be doing well. The following morning the patient was worse. He immediately removed two abdominal sutures, entered his two fingers into the abdominal cavity, and was fortunate enough to find the forgotten sponge. The patient recovered.

In the third case, Spencer Wells was informed by one of his friends, several hours after an operation, that a pair of hæmostatic forceps had remained behind in the abdominal cavity, but, as the patient felt momentarily well, he concluded to wait. On the following morning the patient was worse. He then removed two sutures and inserted two of his fingers into the abdominal cavity, and succeeded in removing a hæmostatic forceps. The omentum had entered into the opening of the handle of the forceps. The patient recovered.

(65) Lawson Tait ("Pathology and Treatment of Diseases of the Ovaries," Birmingham, 1883, p. 261) experienced the following accident. He performed an abdominal section, using twelve sponges, which were all present after the operation. Without the knowledge of Tait, an assistant had torn one sponge in half, and one of these halves remained behind in the abdominal cavity. After four hours the sponge was removed by Lawson Tait.

(66, 67) Terrier. Terrier on one occasion left a hæmostatic forceps in the abdominal cavity. After eight months, the foreign body was discharged in the region of the umbilicus. On another occasion Terrier forgot a sponge in the abdominal cavity after an ovariectomy. Death ensued, caused by septic peritonitis. Since then he never uses sponges, as he is convinced that there is no way to radically disinfect a sponge.

(68) Terillon forgot a hæmostatic forceps in the abdominal cavity.

(69) Thiersch (*Centralblatt für Gynäkologie*, 1898, No. 18) at an autopsy found a sponge in the abdominal cavity after abdominal section.

(70) Thomas Gillard (Wilson, L. C.) performed an exploratory section. The case proved inoperable. A few days later the patient died, and at the autopsy a piece of sponge was found that had evidently crumbled off the only sponge that was used.

(71) Williams (*Transactions of the Edinburgh Obstetrical Society*, 1890, p. 90, Vol. xv). In February, 1890, in a patient aged thirty-two years, mother of four children, a broken piece of a Southey's drain-tube, three by four inches, was found in the Douglas pouch close by the right ligament. The foreign body was surrounded with a peritoneum. The latter was of a brownish color. Between August and October, 1888, the patient was operated on several times for ascites. During one of these operations the Southey drain was used, and no doubt the piece broke off and gravitated to the bottom of the Douglas pouch.

(72) Wilson ("Foreign Bodies left in the Abdomen after Laparotomy," *Gynecological Transactions*, 1884) forgot a sponge in the abdominal cavity after an operation for ovariectomy upon a pregnant patient. Abortion followed eighteen days after the operation, and an abdominal wall abscess followed later, out of which Dr. Hocking removed a piece of sponge. The patient recovered.

The sponge had remained five months in the abdominal cavity. The discharged sponge particles represented a mass the size of a hen's egg, and had broken off during the operation, as all the sponges were accounted for after the operation.

The patient, aged twenty-nine years, mother of three children, entered the hospital February 16, 1883. She was in the fifth month of pregnancy complicated with an ovarian cyst. On February 20 she was operated upon, and on March 9 she had an abortion. On March 16 a tumor was felt in the region of the umbilicus. An abscess ensued, which opened on the thirty-first day after the ovariectomy and fourteen days after the abortion. The abortion was caused by the abscess. On July 15 the first piece of sponge was discharged and on August 7 the wound had healed. The sponge had remained five months and eighteen days in the abdominal cavity. Wilson cited thirty cases of foreign bodies left in the abdominal cavity (*Annales de Gynécologie*, 1885, p. 149). He further states that he knew of twenty-one cases, six of which occurred in America and fifteen in Europe. Of the American cases, five were not published. He was the first to publish his case. Of the six American cases, in five instances a sponge remained, and in one a forceps. Two women died, four were saved. In one case a sponge was discovered missing just before the closure of the abdomen. It was recovered from its location among loops of intestines. In the others the wound was reopened to recover the missing sponge.

In a third case a sponge was missing after the postoperative count. In a fourth case a sponge was found during the autopsy. In a fifth case a pair of forceps was found at the autopsy. The sixth case is the one enumerated by Wilson.

In the thirty cases recorded by Wilson there are three cases reported by Spencer Wells, one by Lawson Tait, another by G. Braun, another by Carl v. Braun, three from Reeves Jackson, one from Thomas Gaillard, one from Howard, one from Atlee, one from Howitz, one from Engleman. In fifteen cases the facts are known without the knowledge of the names, and therefore we can consider these as Cases 72-86.

(87, 88) Von Winkel forgot a sponge in the abdominal cavity during a myotomy, and the fact became known through an autopsy. In another case he forgot a forceps, which was later passed spontaneously in an abscess. (See Bode.)

(89) On another occasion, operator unknown, a Richelot clamp was left behind in the abdominal cavity.

(90) On the 9th of May, 1899, Neugebauer heard of an operation in Warsaw, on which occasion a gauze sponge was left in the abdominal cavity. The patient was brought in with an abdominal wound. The assistant had to perform an operation immediately with the help of the Sisters of

Charity. The abdominal cavity was opened through the median line. The intestines were found unharmed, with the exception of the omentum. He resected the injured part of the omentum. After two weeks an abscess formed, and upon opening the same a gauze sponge was removed which one of the Sisters of Charity had forgotten.

(91) Kosinski forgot, on October 31, 1888, a hæmostatic forceps while performing an ovariectomy. Four months after operation artery clamps recovered from abdominal abscess. Recovery.

(92) Kijewski found a fragment of an irrigator in a woman who had died of nephritis that followed two weeks after an abdominal section. The irrigator, while being held at a considerable height, burst, and a fragment of the glass fell into the abdominal cavity without being observed.

(93) Kijewski found during an autopsy a gauze napkin in the abdominal cavity.

(94-96) Przewoski during autopsies on three occasions found pieces of gauze or a gauze napkin in the abdominal cavity after abdominal sections.

(97) Hefting (*Deutsche medicinische Zeitung*, March 5, 1897). A patient, sixty years of age, upon whom an abdominal section was performed twelve years previously, suffered from intestinal disturbances, especially constipation. She had not had a movement for four days. A movable tumor of the intestine with uneven surface was observed, and castor oil was administered. This was followed by the discharge per anum of a sponge that twelve years previously had been lost in the abdominal cavity.

(98) Marine (*El Siglo Medico*, December 18, 1880, p. 810, Schmidt's *Jahrbuch*, Band xxii, No. 6). An ovariectomy was performed upon a twenty-six-year-old patient. Eight days thereafter the drainage tube disappeared, and a week following its disappearance it was passed per anum.

(99) Rydygier (*Pamixtnik* 11, *Zjazd Chirur.*, Polskich, 1898, p. 121). During a vaginal hysterectomy a sponge was lost in the abdominal cavity. A diligent search failed to reveal the sponge. After seven weeks the sponge appeared in the vagina during an irrigation. The patient finally died of pyæmia, January 16, 1887.

(100) A celebrated German operator related to Neugebauer in the Eighth Congress of Gynæcologists that he had an occasion to perform an abdominal section upon a patient that had been previously operated for an apparently inoperable tumor. An artery forceps that the former operator had accidentally left behind was found in the abdominal cavity.

(101) Professor Krasowski was legally proceeded against for having left a sponge in the abdominal cavity. The suit resulted in an acquittal.

(102) Buschbeck ("Ueber Fremdenkörper in der Bauchhöhle," *Centralblatt für Gynäkologie*, 1899, No. 45, p. 1375). A patient, thirty-four years old, was brought to the Dresden Clinic with a suspected ruptured ectopic pregnancy. The abdominal section was performed by Dr. Buschbeck, who represented Dr. Leopold. The operation was uneventful. The burst left tube and ovary were removed. A great number of gauze compresses were used on account of troublesome intestinal loops. The pa-

tient made an easy recovery and was dismissed after four weeks. After two years of the most perfect health the woman again appeared, complaining of colic in the right side. A rough, irregular swelling the size of a fist was found on the right side of the uterus, which after some months had grown larger and nearer the abdominal wall. The patient was again examined January, 1899, when she had fever and severe pains. The abdominal scar had opened at the lower end. After enlarging the fistula, from which much pus flowed, a gauze cloth appeared that had evidently been left behind in the abdominal cavity during the laparotomy that had been performed two and a half years previously. This had entered the intestine, and was now ejecting itself by way of the perforation. Dr. Stelzner performed another laparotomy with resection of the intestine twenty centimetres in length. The woman recovered.

(103) In the discussion, Leopold cited a case upon which he had performed an autopsy. Death had ensued a few hours after the total extirpation of the cancerous uterus. A gauze cloth was found, but it could not be determined whether it had remained behind in the abdominal cavity or whether it was inserted into the vagina as a tamponade.

(104-106) Herr Meinert mentions in the discussion three similar cases, as follows:

(a) Three weeks after an afebrile laparotomy, painful resistance in the right abdominal half ensued. Incision. Removal of a mull compress that lay close under the peritoneum. The wound was tamponed. Recovery.

(b) A virgin, twenty years of age, with double-sided tuberculosis of the tubes. January, 1893, a pelvic abscess was opened through the vagina. In April of the same year ventral extirpation of the adnexa. Fever followed. On the ninth day a discharge of pus through the abdominal scar. Fever still continued. A through drain from the abdominal wound to the vagina, with daily irrigation. At the end of May, a tumor, the size of a hen's egg, was discovered to the left of the umbilicus. After a few days this changed its position to the left inguinal region, and finally disappeared in the depth of the pelvis. A foreign body was suspected. A tupelo enlargement of the vaginal drainage opening, out of which a long iodoform gauze strip was removed on the 30th of May. This had been left behind from the first operation. Then followed a fistula, which after many relapses finally closed in 1895.

(c) 1896. A patient, upon whom a vaginal operation had been performed, referred to the frequent passage of gauze particles from the vagina. After eight days a small fistula formed on the right side of the vaginal wall. Through this a piece of gauze of an irregular form, the size of a woman's handkerchief, was removed.

(107) J. Merttens ("Ein Fall von Einwanderung einer bei Laparotomie zurückgelassenen Kompress in den Dünndarm," *Centralblatt für Gynäkologie*, 1900, No. 4, pp. 114-116). A peasant twenty-eight years of age. She had been pregnant twice and aborted once. A pelvic abscess followed the abortion. She was confined to her bed from October, 1895, until May, 1896, recovery being retarded. On March 18, 1897, the patient was placed in care of Dr. Merttens. The patient suffered from dysmen-

orrhœa, dysuria, and constipation, and looked very anæmic. The uterus was fixed in an inflammatory mass; the adnexa consequently could not be felt. After a protracted conservative treatment with ichthyol, iodine, glycerin tampons, Moorlaugenbader, hot douches, etc., an abdominal section was performed in March, 1899. Merttens advised her to have a radical operation. The operation was very difficult. After opening the abdominal cavity, the adnexa as much as possible were removed, the uterus remaining. In consequence of the discharge of flatus and fæcal matter, the operation was extremely difficult. The patient was removed to her home at the expiration of two months, but still having pains. Five months after this operation she again called upon Dr. Merttens, complaining of almost continual pains and looking more pitiable than ever. The abdominal section had healed well. Lower abdomen almost well and not painful to touch. Uterus normal but not very movable. The patient herself described her pains as being farther up. Merttens discovered, to his astonishment, a soft, movable mass the size of a fist, that had escaped his former examinations. He suspected that a foreign body had accidentally been left in the abdominal cavity. In view of this, as the pains continued and the patient could not retain anything, Dr. Merttens performed another abdominal section on the 29th of August, 1899. Abdominal section direct over the site of the tumor. The expected foreign body was not at once revealed, but a spindle-shaped swelling representing an intestinal loop was observed. Close to this loop the intestine was of a dark-blue color; it was movable upwards, but beneath the spindle-like swelling it entered the growth. On account of its dough-like substance, it was thought to be a fæcal impaction.

While attempting to draw out the movable intestinal loop, the intestine tore to the mesentrium, just at the edge of the spindle-shaped swelling; out of this swelling a gauze compress was projecting which was covered with fæcal matter. Gauze compresses were arranged to protect the abdominal cavity, the intestine being resected. Drainage by iodoformized gauze strips was practised. The following day the patient had a collapse accompanied with cold extremities and profuse perspiration. Camphor, ether, and narcotics profusely applied finally brought the patient around. On the third day a discharge of flatus. On the tenth day a gradual removal of the gauze, which was completely removed on the twenty-first day without any fistula remaining. After fourteen days she partook of food per os, and after four weeks the patient left the bed. Recovered. The compress which had remained behind had broken into the intestine.

(109) Professor Frankenhauser removed by means of an abdominal section a sponge that had been left behind during an abdominal myotomy. Recovery.

AUTHOR'S ANALYSIS OF NEUGEBAUER'S RÉSUMÉ.

Of these 109 cases forty-three resulted in death, one result unknown.

The following cases in which foreign bodies were left behind recovered.

On thirty-one occasions a sponge, Nos. 4, 5, 9, 17, 20, 22, 23, 24, 25, 26, 27, 28, 32, 33, 35, 36, 52, 53, 56, 61, 63, 64, 66, 68, 69, 71, 72, 73, 87, 101, 109.

On thirty-three occasions a gauze sponge, napkin, or mull compress, Nos. 1, 2, 7, 8, 18, 21, 30, 31, 37, 39, 42, 43, 44, 49, 50, 51, 55, 57, 58, 59, 60, 90, 93, 94, 95, 96, 97, 99, 102, 104, 105, 106, 107.

Unaided nature successfully dealt with the complication in the following cases:

On four occasions a drain-tube, Nos. 6, 47, 70, 98.

On one occasion a Richelot clamp, No. 89.

On nineteen occasions an artery-clamp, Nos. 3, 10, 16, 19, 34, 38, 40, 41, 45, 46, 48, 54, 62, 65, 67, 75, 88, 91, 100.

On one occasion a seal-ring, No. 29.

On seventeen occasions there is no mention made of what kind of foreign body had entered the abdomen.

On one occasion a glass splinter from a burst irrigator, No. 92.

In three cases two foreign bodies were left behind: Two artery-clamps in No. 38; two gauze napkins in No. 2 (the one was spontaneously discharged per anum, the second was removed by abdominal section out of the intestine), and No. 60 (both gauze napkins protruded out of an abdominal wall abscess).

The fate of the patients where an artery-clamp had remained behind: nineteen cases.

In seven cases death ensued after the operation. In six cases death ensued immediately after the operation from sepsis (Nos. 10, 19, 54, 67, 75, 100), and once (in No. 38) after a second operation several months after injury to artery.

In three cases the artery-clamp was discharged spontaneously per anum: No. 45 (after four years), No. 46 (after nine months), No. 48 (after ten months).

On one occasion the artery-clamp entered the bladder in a manner that has remained unknown (No. 62).

On two occasions the artery-clamp was removed from the abdominal abscess: No. 65 (after eight months), No. 88.

On one occasion the clamp was immediately missed before the closing of the wound, and when searched for was found in the cul-de-sac of Douglas, No. 41.

On two occasions the abdomen was reopened to search for the missing clamp and found, Nos. 3, 16.

On four occasions an abdominal section was made later: No. 34 (after one and one-half years), No. 38 (after several months), No. 40 (after two years), No. 91 (after three and one-half months).

Fate of the patients in which sponges were left behind, twenty-nine:

On twenty-one occasions the sponge was discovered at the autopsy. On two occasions the sponge was missed just before the closing of the wound, was searched for and found, Nos. 33, 73.

On three occasions the sutured abdomen was reopened in view of a missing sponge, Nos. 17, 28, 72.

On three occasions an abdominal section had to be performed: No. 61 (after twenty-four hours), No. 63 (after twenty-four hours), No. 64 (after four days).

On one occasion the sponge appeared at the orifice of an abdominal abscess: No. 71 (after five months and eighteen days).

On one occasion sponge particles were gradually discharged from an abdominal fistula: No. 56 (after more than one and one-half years).

Fate of the patients in which drainage tubes remained behind; four cases:

No. 6. An abdominal section four days later to remove a drain tube that had slipped into the wound.

No. 47. The drain tube was discharged from the vagina while dancing, a long time after the operation.

No. 47. A drain tube that had been lost during a paracentesis two years prior (Southey's drain) was recovered in the pouch of Douglas during an autopsy.

No. 98. The tube was discharged per anum after two weeks.

The following cases have been collected by Schachner as an addition to those gathered by Neugebauer.

(1) W. O. Roberts. After an abdominal hysterectomy a small gauze sponge was left behind. Suppuration with its attending symptoms ensued. A week later the wound opened and the sponge was recovered. The patient made a good recovery.

(2) Operator unknown. Louis Frank was called to see a young woman upon whom a vaginal operation had some time previously been

performed by another surgeon. The woman presented symptoms of some inflammatory pelvic condition, and for the relief of this was subjected to an abdominal section. Dr. Frank found a pus-tube on one side and a sponge close by that had been left by the other surgeon. The tube and sponge were removed, and the patient after a tardy convalescence recovered.

(3) Operator unknown. Irvin Abell, while interne in the Louisville City Hospital, assisted in an autopsy upon a woman who had been operated upon by the abdominal method. The history of the case was as follows: A woman, aged twenty-six years, white, had her uterus, tubes, and ovaries removed by the vaginal method. This operation had been performed three years previously. On entrance in the hospital she presented a mass in the left side of the pelvis, for which an abdominal section was performed. A large ovary and hydrosalpinx were found and removed. The patient died seventy-eight hours after the operation with symptoms of intestinal obstruction. At the autopsy a flat sponge was found.

(4) Howard A. Kelly, "Foreign Bodies in the Abdomen after Operation," *New York Medical Journal*, March 24, 1900) reports an exceedingly difficult hysteromyomectomy in which he used drainage. A day or so later he found a hard body in his drainage tract, which proved to be an artery-forceps. This is the only time he has known an instrument to be left in the abdomen in his practice. The patient died as a result of a frightful hæmorrhage from the left uterine artery during operation.

(5) Howard A. Kelly reports another experience in the case of a woman with pelvic abscesses on both sides. He was obliged to leave town soon after operating upon her, and upon returning was informed that she was doing badly. On opening up the wound he was fortunate enough to discover a foul marine sponge just under the abdominal wall. This was removed, a drain was left in, and she recovered.

(6-8) The following three cases are extracted *verbatim* from the above-named article by Howard A. Kelly:

(a) "Operation by my first assistant; median abdominal incision. The tumor was found to be a large fibrous growth springing from the transversalis fascia. The abdominal cavity and the pelvis were not involved. The mass was excised, after much difficulty, from the densely adherent surrounding tissues of the right abdominal wall, and several centimetres of the underlying peritoneum were removed with the tumor. The hæmorrhage was excessive, but finally perfectly controlled, and the wound closed with silk-worm-gut and catgut sutures.

"*Convalescence*.—For ten days after operation the patient's general condition appeared fairly satisfactory. The first dressing was made at this time and healing *per primam* had taken place. The temperature rose to 101° F. on the evening of the second day, but after twelve hours fell to 100.4° F. For the next seven days the temperature ranged between 98.5° and 100.5° F., and the pulse between 90 and 110, varying its rate with the height of the temperature. On the eleventh day the temperature rose to 102.5° F. and the pulse to 120, and both remained elevated afterwards,

but with marked diurnal variations, suggesting sepsis. The general condition of the patient was fair; little pain or discomfort was complained of.

"On December 5, twenty-eight days after operation for the first time, a smooth, boggy, movable mass was detected, extending from the median line to the left flank.

"Second operation, twenty-eight days after the first. Under chloroform anaesthesia an incision was made over the swelling, and a piece of gauze weighing 360 grammes was removed from a cavity apparently completely walled off from the general peritoneal cavity. Much thick, greenish pus was evacuated and the abscess cavity sponged and irrigated. A counterincision was made in the left flank and iodoform gauze placed in the bottom of the cavity and brought out of the lateral opening. The wound was then closed.

"After this operation the temperature soon became normal. The wound was irrigated and dressed daily. The purulent discharge gradually subsided and the drain-tract granulated vigorously.

"Third operation, on the forty-third day. Suddenly, during irrigation of the wound with 50 per cent. boric acid solution, the patient cried out with pain, and her condition became alarming, the face anxious and livid, lips blue, hands and feet cold, the pulse from 130 to 140. The abdomen was negative on examination. As the condition of the patient did not improve after three hours, an exploratory cœliotomy was made, opening the cavity of the abdomen; several hundred cubic centimetres of bloody fluid were found, evidently introduced through the drain-tract at the time of the irrigation. But few intestinal adhesions were met with, and the peritoneal surfaces were for the most part smooth. Several pieces of iodoform gauze were introduced into the pelvis, the ends being brought out at the lower angle of the abdominal wound. This was followed by an uninterrupted recovery; the drainage was gradually removed, and her temperature and pulse were normal during the last three weeks of her stay in the hospital. She was discharged 'well' on January 16, 1899."

(b) The next accident of this sort occurred in a woman, aged forty-five years, from whom a multilocular ovarian cyst, having dimensions twenty-five by twenty-nine by eight-tenths centimetres, was removed. The operation presented no unusual difficulties. She was simply profoundly exhausted on returning to the ward, but responded to treatment and gained slowly in strength. The wound, dressed on the tenth day, was found to have healed *per primam*.

From the ninth day after operation there was some irregularity of temperature, which, before normal, now ranged daily from 97° to 99.5° F. After the twenty-second day these variations became more marked. The pulse remained rapid throughout, and the general condition did not improve. She had a slight attack of pleurisy in the sixth week, followed by an irritating persistent cough. Some sordes collected in the mouth, yielding slowly to treatment. She was restless at night and extremely nervous, and had a capricious appetite; but there was nothing to suggest an abdominal complication until two months after operation, when

a slight prominence in the abdominal wall was noticed. The elevation was six centimetres in diameter, and lay six centimetres median to and above the anterior superior iliac spine. Distinct fluctuation was detected at the summit.

Second operation. On the seventy-fifth day after the cystectomy, under chloroform anæsthesia, a free incision was made over the prominence and an abscess cavity entered, completely walled off from this peritoneal cavity, and a large gauze pad removed. A considerable quantity of purulent material was evacuated and the wound washed out and packed with iodoform gauze. Almost immediately afterwards the temperature fell to normal, and did not rise subsequently above 99.4° F. The improvement from this time, though slow at first, was steady, the appetite increased, and she gained steadily in weight and strength.

She was discharged "well" on March 9, 1899, a hundred and twenty-nine days after admission. Seen recently, about a year after operation, she was found to be in the best of health and about fifty pounds heavier.

(c) The operation, a simple cystectomy, with the removal of an adherent vermiform appendix, proceeded in an entirely satisfactory manner, and at the end of the operation, upon inquiring of a trusted assistant of large experience whether any gauze was left, he counted carefully and assured me all had been removed.

The patient had suffered for years with severe headache and pain in the left lower abdomen, thought by her physician to be due to sciatica.

For three days after the uncomplicated operation the patient's condition was fairly satisfactory. She was nauseated following the ether anæsthesia, but had a good night, with a pulse ranging from 87 to 104. On the second day she became somewhat restless, and there was frequency of micturition, followed by involuntary voiding. There was no marked abdominal pain.

The temperature during these three days rose once to 100.5° F.; the pulse was of good volume, varying in rate from 87 to 110. Nourishment was well taken, and the bowels were easily opened. The restlessness persisted, however, and a severe burning pain was complained of in the abdomen.

On the fourth day she became more nervous, and the abdominal distress increased when she began menstruating. About noon considerable intestinal distention was noticed, the tongue became parched, and there was some nausea. These symptoms seemed to abate under palliative treatment, but that night, the fourth day after operation, the temperature rose to 103.4° F., the pulse to 118, and she became evidently weaker. Urine and fæces were then passed involuntarily and the abdominal pain increased.

The next day the abdomen was opened under chloroform anæsthesia. The intestines were found distended, reddened, and covered with lymph. On the right side of the abdominal cavity a large piece of gauze, adherent to bowel and surrounded with pus, was discovered and removed. The pelvis contained several ounces of bloody serum.

After this second operation the temperature reached 105.2° F.; the

pulse was weak, 110 to 124 a minute. There was marked asthenia, and she did not respond to vigorous stimulation; the incontinence of urine and fæces continued. The temperature rose to 106° F. and pulse to 140, weak and running, and she died quietly at 6 P.M.

(9) F. W. Samuel, March 5, 1899. Patient aged thirty-eight years. Uterine fibroid and double pyosalpinx. Abdominal operation. Death third day following. Only sixteen ounces of urine in the first twenty-four hours after operation, and a few drachms afterwards. This showed albumen, abundant hyaline and granular casts. Urinary examination previous to operation showed nothing abnormal. Autopsy was made, during which a flat sponge was recovered from the abdominal cavity. Kidney sections showed acute cloudy swelling.

(10) Horace Grant. A man was brought into the City Hospital suffering from a gunshot injury of the abdomen. A laparotomy was performed for the relief of this condition. The man lived a number of hours after the operation, and at the autopsy two gauze sponges were found matted together.

(11) T. S. Bullock. In operating for ventral hernia following a former laparotomy a gauze pad was left in the abdominal cavity. The patient did nicely for three days. On the fourth day she developed a slight fever, and also complained of griping pains in the lower part of the abdomen. The wound was examined and found to have united, except at the lower angle, from which a profuse discharge of non-odorous sero-sanguineous fluid escaped. There was no distention of the abdomen and no tumor. This continued until the seventh day, when the discharge became offensive and the wound began to look bad. The stitches were taken out on the eighth day. At the lower angle a cavity was noticed from which a missing gauze pad was extracted. It measured seven inches in length and five inches in width, weighing 160 grains. After a tardy convalescence the wound entirely closed.

(12) Operator unknown. The following case was reported by Dr. Robert G. Le Conte. A patient had been operated upon for abdominal pains and swelling, which proved to be of a tubercular nature; as a result of this operation a sinus persisted, discharging from time to time small amounts of liquid fæces. At this time the patient came under Dr. Le Conte's care. Her weight was sixty-five and one-half pounds, and she was a most miserable-looking object. In a few days the sinus began to enlarge. On February 10 something could be felt at the bottom of the sinus. A pair of forceps was introduced and a piece of gauze about five feet long and a yard wide was removed. The wound finally healed, and the patient left very much improved. (*ANNALS OF SURGERY*, Vol. xxxiii, p. 209.)

(13) Personal communication. Name withheld. A boy nine years of age was operated upon for an appendicitis of two weeks' duration; the abscess was a large one, extending to the liver, with gangrene of intestines. A counteropening was made in the loin and the abdomen packed with gauze. After the sutures were removed, he continued to discharge pus freely, and abscesses appeared at different parts of the body, evidently

pyæmia. About three weeks after the operation a gauze pad appeared at the wound, and after its removal recovery promptly followed.

(14, 15, 16) Robert F. Weir. (See personal communication.) In three cases foreign bodies were left in the abdominal cavity, the one was a sponge and the other two gauze pads. The first resulted fatally; whether from the sponge alone, or from the general peritonitis of an appendical origin which demanded operation, I am unable to say; the other two recovered from the mishap, one in five days, the other in five months.

(17) R. Matas. (See personal communication.) On one occasion a strip of iodoform gauze pack remained buried in granulations, and was finally covered over entirely. The patient returned six months after with a suppurating sinus, the exploration of which led to the discovery of the gauze. The sinus healed with the removal of the foreign body.

(18, 19, 20) George R. Fowler. (See personal communication.) On three occasions gauze pads have been left in the abdominal cavity. Result not mentioned.

(21, 22) A. Vander Veer. (See personal communication.) On two occasions foreign bodies were left in the abdominal cavity. One instance occurred a few years ago when using old-fashioned sponges. The patient died from a general peritonitis. The other occurred three years ago in a case of extensive carcinoma of the uterus. A small sponge was left, the patient making a good recovery. On the reappearance of the disease a year later, an exploration was made, resulting in the finding of the sponge.

(23, 24) Operator unknown. Reported by William R. Pryor. (See personal communication.) On two occasions iodoform gauze was left in the pelvis after vaginal operation. No names or details given.

(25) Charles Noble. (See personal communication.) Sea-sponge was left in the uterovesical pouch. The patient made an uncomplicated recovery and returned home. Some weeks later she developed inflammatory symptoms, and had what was supposed to be an abscess anterior to the uterus. The abdomen was reopened, and the cause of the inflammation found to be a sponge. The leucocytes had almost disintegrated the sponge.

(26, 27) Operators unknown. Dr. J. B. Murphy (see personal communication) reported two cases, both occurring in the hands of other operators,—in the one two laparotomy sponges were allowed to remain, and in the other, a large fragment of gauze. No names or further details given.

(28, 29) Matthew D. Mann. (See personal communication.) In two instances foreign bodies were allowed to remain in the abdominal cavity. In one, a hæmostat, which was removed within an hour after the operation, no harm following. In the other, a large flat sponge remained in the abdominal cavity over night, and was also removed without detriment to the patient.

(30, 31, 32) Operators unknown. Reported by Matthew D. Mann. (See personal communication.) In three instances in the practice of other surgeons, names not mentioned, gauze pads have been left behind in the

abdominal cavity, two of the patients dying, whether from the effect of the pad is unknown. In the third instance, some months after the operation, the pad was discharged through the abdominal wall at the site of the incision. The patient recovered.

(33) E. Lewis. (See personal communication.) A medium-sized gauze sponge was introduced to press the intestines back while suturing. The sponge was forgotten. The patient did very well. Very little temperature. The sutures were removed on the tenth day. Union was perfect. About the fourteenth day a localized swelling occurred in the scar, which opened. In enlarging the opening, the sponge was noticed and withdrawn. The patient finally recovered.

(34) Archibald MacLaren. (See personal communication.) A piece of gauze was left in the abdominal cavity after an operation for suppurative appendicitis. The wound partly closed. After a stormy convalescence, the sponge worked its way to the surface and was removed from the drainage tract three weeks after the operation. This case is an additional one to two others by the same operator, both of which are reported in Neugebauer's list.

(35) Arpad G. Gerster. (See personal communication.) A small iodoform packing slipped away during a stormy celiotomy for inoperable cancer. As there had been much fever before the operation, and the local symptoms caused by the foreign body not very distinct because of the slow peritonitis, the case remained unexplained until the autopsy revealed the actual facts.

(36) Operator unknown. Frank Hartley (see personal communication) referred to a case in the practice of another surgeon where not only a gauze pad but a clamp attached to it became lost in the peritoneal cavity. No names or other details.

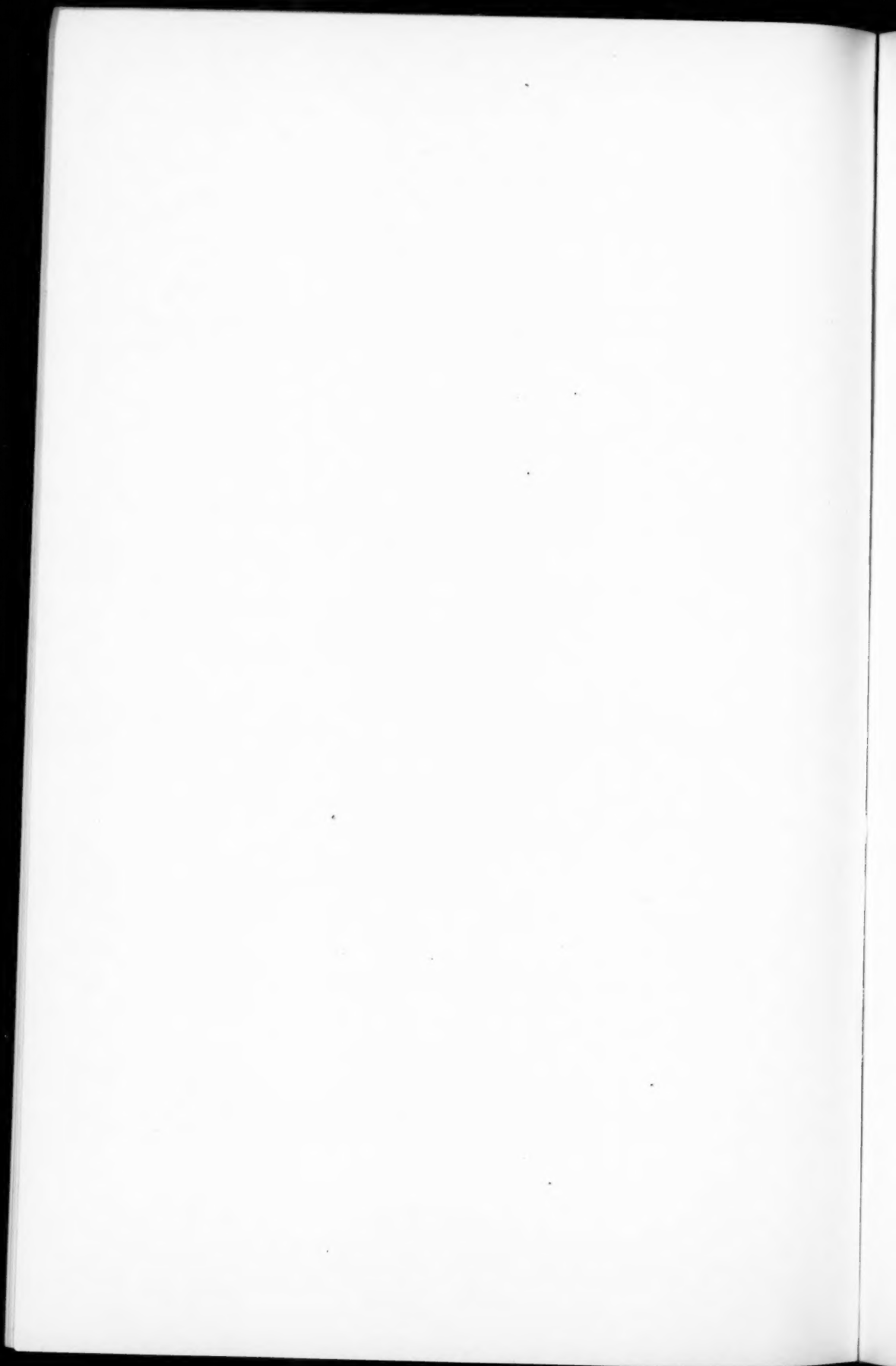
(37) B. C. Hirst. (See personal communication.) During an abdominal section, the assistant, an older surgeon, tore one of the sponges in halves and tucked one half between the bladder and ureters, without mentioning the fact. The woman died of shock, and the sponge was removed at the autopsy, much to the surprise of every one, since the count at the close of the operation gave the correct number of sponges.

(38) Operator unknown. George Ben Johnson. (See personal communication.) During a hurried operation by another surgeon, who relied upon his nurse for the count, the abdomen was closed with a sponge remaining within. For the first ten days the patient did well, then a localized peritonitis developed, and a swelling occurred near the umbilicus. The abscess finally ruptured. A faecal fistula resulted, and for this she consulted Dr. Johnson, who undertook to operate for the relief of this condition. An extremely large opening was found in the small intestine. A rapid end-to-end anastomosis was made with a Murphy button. Dr. Johnson was convinced that a foreign body was left in the abdomen, and, getting no history of its expulsion, a few days after operation made a digital examination of the rectum and found in it a large gauze pad.

(39) Wm. M. Polk. (See personal communication.) During an abdominal section performed ten years prior, one of the sponges was



FIG. 3.—Showing tumors removed from the author's case.



divided and one-half remained behind in the abdominal cavity. Result not mentioned.

(40) A. Schachner. (Original report.) Mrs. X., aged forty-three years, colored, occupation, laundress, was referred to me by Dr. George F. Simpson. At the time of examination the woman was and had been bedridden for weeks. She was a nullipara. Her menstrual history had the customary attacks of menorrhagia and metrorrhagia. Examination revealed a multiple fibroid condition of the uterus. By external and combined examinations, the conclusion was reached that the tumor was movable and devoid of any especially difficult attachments. She was operated upon before a limited number of members of the senior class of the Louisville Medical College, but not in the college clinic. An abdominal incision was made from the umbilicus to the pubes. The tumor consisted of four principal masses having the size of foetal heads. The more superficial masses were readily delivered. The deeper ones were managed after most difficult and laborious efforts. The adhesions were dense, and the tumor had assumed such relations that when all the masses were delivered a portion of the aorta remained exposed. Many clamps and hæmostatic forceps were necessary to control the bleeding points. At one time during the operation the condition of affairs appeared truly hopeless, and it was believed that a really inoperable case had been attacked.

After the lapse of two months the woman was again upon her feet following her old occupation of laundress. During the postoperative course a urinary fistula developed in the wound, and after continuing for ten days ceased spontaneously. The wound entirely healed, the patient continuing free of any pain or discomfort for seven months after the operation. At that time I was again called by Dr. Simpson to see the patient, and found her suffering from intense abdominal pains. There was no elevation of temperature, but marked symptoms of intestinal obstruction. This onset was rather sudden and lasted for eight hours, when she was removed to the Louisville City Hospital. A second abdominal section was performed upon her at midnight. Numerous fibrous bands were encountered, together with a mass of small intestines. Upon manipulating these intestinal loops, two ring-like bodies were felt through the intestinal wall. The intestine was incised, and a pair of hæmostatic forceps removed which had been accidentally left behind from the former operation. The intestine was closed and the patient made an unbroken recovery.

(41) Operator unknown. Dr. John A. Wyeth, in a private communication, mentioned an instance where he had witnessed the removal of an artery-forceps at a post-mortem. The operation had been performed in a New York hospital, but the name of the operator was not given.

(42, 43) Operators unknown. Dr. Arthur J. Boyd, in a personal communication, reported two instances in which pads were left in the abdominal cavity. These cases occurred during Dr. Boyd's internship in a Louisville infirmary. The names of the operators were not given. A woman had been operated on for an ectopic pregnancy. A number of gauze sponges were used, and at the close of the operation it was supposed

that all of the pads were removed. The patient did fairly well for a time, but later began to complain of pain, together with the formation of a fistula. She became emaciated and lost flesh. During one of the dressings some time after the operation a gauze pad presented itself at the fistulous opening and was removed. The removal of the pad was attended with a prompt recovery. Another patient had been operated upon for diseased adnexa. The operator was informed that one pad was missing. A search was made, but no pad was found, whereupon the operator insisted that none could have been overlooked, notwithstanding the fact that the assistant and sister both insisted that one must have remained behind. The patient lived about two days, during which time she complained of great pain in the region of the spleen. She became tympanitic, and died with symptoms of acute septic peritonitis. No post-mortem.

(44) Dr. Wm. T. Bull, in a personal communication, reported a case where a large flat sponge was left in an open cholecystotomy. It was recognized on the fifth day, when the gauze packing was removed. Recovery.

(45) Operator unknown. In a personal communication, Dr. Henry O. Marcy mentions an instance in the practice of one of his colleagues where a thick gauze pad was left. Result not mentioned. This same correspondent referred to a large diamond ring that had remained for six months in the abdomen of a woman. The name of the operator withheld. Several reports have been received concerning rings that have been left, which made it impossible for the author to determine whether these were different cases or whether they represented one case that had received uncommon notoriety.

(46) Operator not mentioned. Dr. Henry O. Marcy in the same communication referred to a sponge that one of his colleagues in Boston had left with fatal issue.

In closing, the writer begs to submit the following conclusions:

(1) So long as surgery continues an art, so long will foreign substances continue to be unintentionally left in the abdominal cavity.

(2) That the recorded cases are not representative of the true frequency of this accident.

(3) If the foreign body is of an aseptic character, nature endeavors to care for the same by encapsulating the foreign substance primarily in a fibrous exudate interspersed with leucocytes, and secondarily enclosing it by the contraction of adhesions between the different abdominal viscera or the viscera and abdominal wall.

(4) In the spontaneous expulsion of a foreign body from

the abdominal cavity nature seeks exit through points of least resistance, which are either the alimentary tract or an imperfectly united wound, or less frequently through the reopening of an apparently well-organized cicatrix.

(5) A foreign substance may remain quiescent for years in the abdominal cavity.

(6) The disturbance which a foreign body creates in the abdominal cavity depends upon its sterility, size, character, *e.g.*, regularity of outline and presence of sharp or pointed surfaces; density, point of location, individual tolerance of the peritoneum, and behavior of the individual.

(7) The symptoms of a foreign body in the abdominal cavity may vary from *nil* to that of the most violent intra-abdominal disturbance.

(8) The symptoms not infrequently suggest a low and protracted form of sepsis or an ileus.

(9) Unexpected circumstances, unusual complications, and diverted attention explain many of these accidents.

(10) While the counting and recounting of sponges and pads before and after an operation by one or more individuals should and always will be a most important feature in the prevention of this accident, yet the cases are numerous where the accident occurred notwithstanding this count by one and even two nurses or assistants.

(11) The plan of attaching tapes or threads to pads and instruments has received the recommendation of many operators, but the fallibility of this is as clearly proven as the former.

(12) In restricting ourselves to the smallest number of pads, sponges, and instruments, we adopt a system of simplicity that must appeal to all as one of the most important elements in the avoidance of this accident.

(13) We can only hope to reduce these accidents by the observance of the highest degree of simplicity, system, and watchfulness.

(14) If the surgeon at the close of the operation asks for a count of sponges, and this is made, and an assurance

given that all sponges and pads are present, his responsibility upon this point ceases; for it is neither prudent nor fair that he should leave his, the most important, part to do duty that justly belongs to the nurse.

(15) The real factors in the avoidance of this accident are the recognition of system, simplicity, and watchfulness to the most exacting degree.

(16) At the bottom of most of these accidents we find a diverted attention, a defective system, or a dangerous degree of complexity.

(17) We are obliged to conclude that to a certain extent the surgeon is responsible for things about the operation, and after that the responsibility must rest elsewhere.

(18) No hard and fast rules can be made regulating the responsibility in every case, but each will be required to be decided upon its own merits, and the responsibility be fixed accordingly.

(19) There are risks that the patient must assume and that cannot rightfully be transferred to the operator. (Sanger, of Leipzig.)

(20) In other vocations it is reasonable to assume that, unless properly prepared, one should not act; but in surgery one is occasionally compelled to act, even though it is known that he is not prepared, and in these conditions to adopt any other course than that would be attended with the loss of more lives than if we did not make the best of the circumstances.

In closing, I beg to gratefully acknowledge the assistance of Dr. Howard A. Kelly, of Baltimore, who kindly supplied much important reference literature upon this subject.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 8, 1901.

PARKER SYMS, M.D., in the Chair.

SUBPHRENIC ABSCESS.

DR. J. A. BLAKE presented a young woman, aged twenty-one years, who was operated upon at the Roosevelt Hospital for appendicitis on January 6, 1901, by an intermuscular incision. An abscess containing about four ounces was found behind the cecum. In separating the adhesions, the parietal peritoneum, which was very much thickened, was separated from the abdominal wall. The stump of the appendix was inverted, and, in order to facilitate drainage, the muscles were divided upward for an inch and a gauze-drain was inserted. The postoperative course of the case was uneventful for about a week, the temperature becoming practically normal; then, after a week of irregular fever, signs of a dry pleurisy developed at the right base. In the next few days the friction sounds disappeared at the base, but were made out just below the angle of the scapula, and in the same region there was dulness, below this there was a peculiar tympanitic note followed by flatness at the base; the voice and breathing were diminished, becoming lost at the base. A needle introduced in the ninth space withdrew thin, stinking pus. The needle did not move with respiration. The patient at this time was markedly septic and in bad condition.

Operation. Excision of two and a half inches of the tenth rib in the post-axillary line; the parietal pleura appearing normal, an aspirating needle was introduced and pus withdrawn. The pleura was then incised and found normal and in contact with the diaphragmatic pleura. The opposed pleural surfaces were then carefully united with catgut, and the diaphragm stitched with

several heavy silk sutures to the margins of the chest wound in order to prevent its separation when the pressure from below was relieved. Inasmuch as pus was escaping from the needle puncture, an incision was immediately made through the diaphragm into the abscess cavity, and about eight ounces of pus escaped. A double rubber drain was inserted. Convalescence was uneventful.

Dr. Blake also presented a second case, male, aged twenty-seven years, who was admitted to St. Luke's Hospital in July, 1900. He gave a history of having had for six months a dull aching pain in the right chest near the sternum and in the right shoulder, accompanied with anorexia, malaise, feverishness, and a loss of sixty-five pounds in weight. For six weeks he had also had a cough with an abundant expectoration of a thick, reddish sputum. He was anæmic and only fairly nourished. Examination of the chest elicited the following signs: on the right side the base was bulging and more prominent than on the left; the right side measured sixteen and a half inches, the left side fifteen inches; apices negative, except for bronchial expiration on the right; dullness and feeble breathing in right interscapular region; from the angle of scapula to within four inches of base tympanitic resonance and increased vocal fremitus, feeble breathing and subcrepitant râles; from this down flatness, absence of vocal fremitus and breathing, and modified voice. Liver dullness commenced at fifth space, flatness at sixth space, and extended one inch below free border of ribs. Margin of liver was not palpable. Abdominal walls were rigid, otherwise abdomen was negative. The sputum was thick, reddish-brown in color, and somewhat fetid. It contained yeast cells, thrush, and other fungi, but no tubercle bacilli. A needle introduced in the ninth space posteriorly withdrew thick, reddish-brown pus. Examination of the pus showed granular débris and degenerated cells. There was a leucocytosis of 19,000, and the hæmoglobin was 45 per cent.

Operation. Under nitrous oxide and ether anæsthesia, an incision three and a half inches long was made over the ninth rib in the post-axillary line, and two and a half inches of the rib excised. The pleura was then incised, and, contrary to expectation, no adhesions were found between the costal pleura and lung. The lung, however, was adherent to the diaphragm, and, although it receded from the chest wall, its base was fairly fixed by its

adhesion to the former. There was still, however, quite an interval between the chest wall and the junction of the lung with the diaphragm, which was overcome by excising an equal amount of the tenth rib, thus allowing the costal pleura to be depressed to the lung and diaphragm, to which it was sutured with mattress sutures of chromic gut. The original incision in the pleura was closed, inasmuch as it was too high. The wound was then packed, and, after waiting for three days for adhesions to form, a needle was introduced, pus found, and an incision made allowing about two pints of reddish-brown pus to escape. The finger entered a large cavity, evidently the pleural cavity, the lung having been torn from its adhesions in some fit of coughing in the interval between the operations. The finger readily detected an opening in the diaphragm one and a half inches in diameter leading to a wide, shallow cavity. Two large drainage tubes were introduced. The convalescence was tedious, resembling that of an ordinary empyema. The temperature remained normal after the twenty-fifth day. The cavity had contracted to a sinus three and a half inches deep at the end of six weeks, and at the time of his discharge, four weeks later, there was still a narrow sinus two inches deep.

The chief point of interest in these cases, according to the reporter, lay in the physical signs as exhibited in them. In both there was an area of tympany posteriorly, lying above the area of flatness. His attention was first called to this as a diagnostic sign by Dr. W. T. Bull, who told him of a case in which a diagnosis of subphrenic abscess had been made by Dr. E. G. Janeway chiefly by this symptom. He had also noted it in another case of subphrenic abscess which was under his care some years ago.

The tympanitic note is due possibly to the compression of the lung from below, and is analogous to that noted in some cases of pleuritic effusion, generally at the anterior part of the chest, and which was first described by Skoda.

The first case illustrated a point in the etiology of subphrenic abscess following appendicitis; namely, the causative influence of the position of the appendix. In his experience, subphrenic abscess and infections of the pleura and lung have only resulted in those cases in which there had been a retrocæcal position of the appendix, and in which there had been marked involvement of the parietal peritoneum in the suppurative process.

CONGENITAL OSSIFICATION OF THE SAPHENOUS VEIN.

DR. ROYAL WHITMAN presented a boy, seven years old, who had an ossified ridge of tissue extending along the inner side of the right leg, from the pelvis to the foot. According to the history, this was noted at birth, and when the child was one year old he was operated on at Budapest, where a small section of the hardened ridge was removed from its upper and lower extremities. Subsequently, the child was admitted to the Hospital of the Ruptured and Crippled on account of the ankylosis of the knee produced by this mass. In order to free the knee-joint, the mass was cut away from the knee to the foot, while that between the knee and the pelvis still remains. The child has now very good power of flexion and extension.

Dr. Whitman said the case was unique, so far as his experience went. The lesion is apparently an ossified angioma of the saphenous vein. The skin has also become involved in the process of ossification, and bleeds very freely and for a long period of time when it is broken. The question arises whether it is worth while or feasible to remove the enormous ossified mass which still remains in the thigh and extends up into the pelvis.

In reply to a question, Dr. Whitman said that the pathological report of the section he removed had not yet been made. He did not regard the case as one of ossifying myositis, as the lines of demarcation between the muscles were apparently normal. In the region of the knee-joint, the bony mass had become adherent to the tibia and femur. The mass was composed of comparatively soft bone, and was riddled with channels communicating with the skin, which itself was hard.

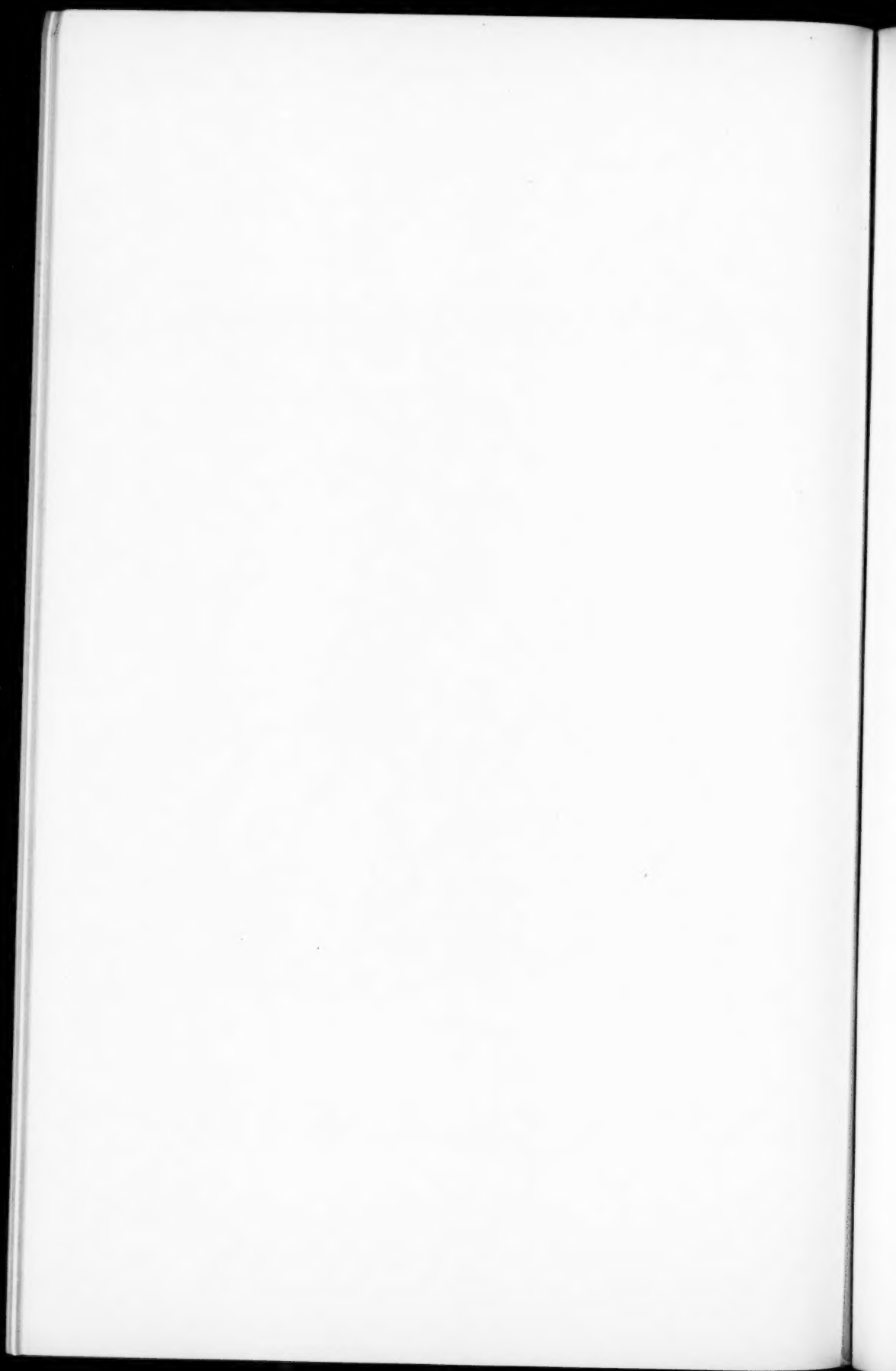
In reply to a question as to whether the mass had apparently sprung from osteophytes in the neighborhood of the knee-joint, and extended upward and downward, Dr. Whitman said he did not think so. It had evidently grown only with the growth of the child, as the father states it was there at birth.

MULTIPLE KELOIDS.

DR. BENJAMIN T. TILTON presented a colored woman, a native of New York State, and a laundress by occupation. Her parents died of unknown causes, and one brother died of dropsy.



Multiple keloids.



When the patient was eight years old she received a burn on the right side of the forehead; this readily healed; but she states the line of the scar "filled out" and left a hard nodule, the size of a marble. This was her first keloid, and it disappeared spontaneously in less than a year.

About three years later, a small, double elongated tumor appeared on the left lower ribs, and gradually increased in size. It was not painful nor tender, and was removed at the age of sixteen by a surgeon in Richmond, Virginia. About a year after the operation she noticed that the scar began to "fill out." This secondary tumor was painful and tender, burning and smarting, as she expressed it, and grew to be twice the size of the original tumor. It was kidney-shaped and about four inches in length. Her next keloids appeared spontaneously on the right side, below the free margin of the ribs, and attained the size of the palm of the hand. Subsequently others appeared on the left shoulder-blade and in the middle of the back as well as in the lumbar region. These grew quite rapidly until they reached a certain size and sometimes coalesced, thus forming bands of keloidal tissue.

Seven years ago the woman submitted to four operations at Bellevue hospitals in the course of one year, and all her keloids were removed. Many of the growths, however, recurred within a year's time. There is one growth on the right side of the face which has been removed five times in twelve years, each time recurring and attaining its former size within twelve months. In addition to the keloids on the body, she has a tumor on each ear, springing from the point where the lobes were pierced for ear-rings when she was sixteen years old. Three years ago she had a boil at the left angle of the jaw; this was pricked with a needle, and subsequently a keloid appeared at the site of the furuncle.

In August, 1900, the woman became an inmate of the Colored Home and Hospital, and soon afterwards the tumor on the right ear and cheek was removed. The large defect was then covered with skin-grafts which were taken from the inner side of the thigh, which subsequently became the site of another keloidal growth. At a second operation, a keloid was removed from the abdomen; this operation being undertaken because the growth

had broken down and suppurated. Other tumors were also removed from the left side and shoulder, but they rapidly recurred. The patient now complains of pain and burning sensations at the site of all these tumors.

DR. GEORGE WOOLSEY spoke of the use of thiosinamin in the treatment of these cases. Last year he saw a colored man, a parlor-car porter, with a keloid over the region of the sternum which gave rise to a good deal of itching in warm weather. A 10 per cent. solution of thiosinamin was employed, and after twenty-five injections into the buttocks there was a very decided change in the fibrous mass. The keloid was less elevated than before; its central portion being almost flat with the skin, and the itching and irritation had subsided entirely. Its elevation was reduced fully one-half.

ACUTE INTESTINAL OBSTRUCTION FOLLOWING APPENDICITIS.

DR. L. W. HOTCHKISS read a paper with the above title, for which see page 660.

DR. WOOLSEY said he had had but a single experience of this kind, and that occurred shortly after a primary operation for appendicitis. The omentum was adherent, and lay between the anterior abdominal wall and the colon. At the second operation, which was done five or six days after the primary one, this portion of the omentum was found to be very much thickened and riddled with small abscesses. It had apparently caused an obstruction of the bowels due to pressure, and upon its removal all the symptoms of obstruction disappeared.

Dr. Woolsey said he wished to add a few words about the importance of not using drainage and of leaving in salt solutions, as illustrated in the following case, which had recently come under his observation. The patient, a woman, was operated on for a cyst in the left half of the pelvis, and four weeks later, while apparently convalescing, she suddenly had an attack of acute intestinal obstruction. Her symptoms came on after the administration of a couple of compound cathartic pills. Her bowels did not move after taking the pills, and she complained of a good deal of griping. The obstruction was practically complete, no flatus

being passed; and all the measures resorted to for relief, including high injection, washing out the stomach, and so on, proved ineffectual. After the symptoms had persisted three days, Dr. Woolsey operated, and found that the obstruction was due to adhesion between loops of intestine.

DR. WILLY MEYER emphasized the importance of early diagnosis in cases of intestinal obstruction following appendicitis. This complication should always be strongly suspected if the uneventful convalescence of a patient who has been operated on for acute appendicitis is suddenly interrupted by vomiting and the symptoms of intestinal obstruction, no matter if they come on a few days after the operation, or two weeks after, or even later. The diagnosis is made still more certain by the presence of localized meteorism and peristaltic contractions. The diagnosis of intestinal obstruction occurring shortly after an operation for acute appendicitis is much simpler than when it occurs later, say a year or a year and one-half later: it is particularly difficult to recognize in cases where the obstruction is incomplete, so that gas is still able to pass and the abdomen is contracted and soft.

An operation for intestinal obstruction should not be delayed until faecal vomiting has set in. If the patient is carefully observed, the diagnosis can usually be made before the occurrence of faecal vomiting. In operating, the median incision is usually preferable. We should first strive to find and relieve the obstruction, and then, if necessary, incise the gut and relieve the overdistention. If this is done, there will be no difficulty in returning the coil of intestine to the abdominal cavity.

Dr. Meyer said that, although he had hitherto neglected to wash the abdominal cavity with saline solution after operation in these cases, he regarded it as an excellent procedure. It has been recommended by so many trustworthy men that we must accept the value of it. As regards the comparative value of the intravenous and the subcutaneous infusion of salt solution, Dr. Meyer said he favored the former method if there is sufficient assistance at hand.

DR. HOTCHKISS said that in the last case which he reported the intestines were so widely distended that even very slight manipulation caused the peritoneum to crack in several places. The intestines were incised, rapidly emptied, and resutured,

and then the obstruction was found without any difficulty. In the other cases, which were seen earlier, the obstruction was found without delay.

Dr. Hotchkiss said that the introduction of salt solution by the subcutaneous method was more convenient than by the intravenous method, and the results obtained appear to be quite as efficacious.

TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, May 6, 1901.

The President, DE FOREST WILLARD, M.D., in the Chair.

CARBOLIC ACID TREATMENT OF ANTHRAX.

DR. LOUIS H. MUTSCHLER read a paper with the above title, for which see page 555.

DR. JOPSON said that he had reported a case eighteen months ago, with Dr. Ghiskey, which he had observed at the Episcopal Hospital, where, it will be noticed, a number of cases had been first seen. The Episcopal Hospital is located in a large manufacturing district, where woollen mills and tanneries are in operation. Many of the workmen who apply there for treatment are particularly exposed to this form of infection. He had collected four cases occurring in Philadelphia, besides his own, including one, which Dr. J. Chalmers Da Costa had given him notes of, seen at the Jefferson Hospital. His own cases—five—and those referred to by Dr. Mutschler made ten cases of this rare and malignant disease occurring in this city.

He found on questioning his patient, and several other tanners at the Episcopal Hospital whom he treated, that they had no knowledge of any such disease as anthrax, and that there were no precautions taken in their work to prevent infection. In the article on Anthrax in Clifford Allbutt's system, written by Bell, who was the first to point out the true nature of the pulmonic form of the disease, he mentions that in the wool-working district in Bradford, England, where anthrax has frequently occurred, a number of measures have been instituted to protect the workers. Ravenell, of this city, has done some work on the possible sterilization of hides for destruction of anthrax germs and

spores. It seemed to him that the attention of the Agricultural Department and of the business community, especially the employers of men who handle such things as hides and wool, should be called to the possibilities of protecting them against such a malignant condition as anthrax.

DR. J. CHALMERS DA COSTA said that in the case which came to the dispensary of Jefferson Hospital, it was recognized clinically as undoubted anthrax, and the culture developed the characteristic organisms. He never knew what became of the man, who refused treatment and was not traced.

The Philadelphia Hospital case which Dr. Jopson had mentioned he saw, and was misled as to the condition, thinking it was malignant œdema; the œdema was so marked it led to diagnostic confusion before cultures were obtained.

It seemed to him important to remember that leather-workers are liable to other forms of ulceration, one being undoubtedly the tubercular ulcer probably identical with the verruca necrogenica of Wilkes, the other being an ulceration resulting from the acids employed in tanning.

DR. DE FOREST WILLARD. Those who handle hides occasionally suffer from a very peculiar form of ulceration which he had observed eight years ago. It is apparently due to coccidia or yeasts, and is possibly a dermatitis due to blastomycetes.

DR. MUTSCHLER remarked that in the case of the ulcer on the arm, had this been his case, he would have dissected the ulcer out entirely, then applied the pure carbolic acid to the raw surface, and left it open as a granulating sore. That would have materially shortened the course of the disease. In his cases, the sore being so near the eye, he did not think it justifiable to do this.

THE ULTIMATE RESULTS OF AN INTERSCAPULO-THORACIC AMPUTATION.

DR. ROBERT G. LE CONTE reported the latter history of A. E. T., a patient subjected to interscapulo-thoracic amputation in April, 1899, and shown at the May, 1899, meeting of the Academy of Surgery (see *ANNALS OF SURGERY*, September, 1899). The man had a recurrent sarcoma of the shoulder, which microscopical examination proved later to be mostly composed of spindle-cells. Five weeks after the operation the man went on duty as elevator-boy in the Pennsylvania Hospital, and remained at work until

twelve hours before his death. During the summer and fall of 1899 his health was very good, except for an occasional slight attack of asthma with dry cough. In November, 1899, he noticed a small nodule the size of a split pea under the skin, at about the tubercle of the first rib. By January 1 this had grown to the size of an almond, and he consented to have it removed. It was excised, the periosteum of the rib being removed with it. By the end of April, 1900, a second nodule was made out in the same relative position as the first. This was excised in June, when half the thickness of the first rib was removed with it. No further local recurrences occurred. His chest was carefully examined about every three months for signs of metastases, but nothing definite was ever demonstrable. He continued in fair health, neither gaining nor losing much in weight, but having asthmatic attacks, with shortness of breath, at recurring shorter intervals, until the evening of February 24, 1901, when he complained of severe pain in the chest, very difficult respiration, and a short, hacking cough, with bloody expectoration. The pulse was small and rapid, heart action feeble, and temperature 100° F. He did not respond to free stimulation, gradually growing weaker and respiration more difficult, until he died, the morning of February 25, 1901.

The post-mortem examination was made by Dr. Newlin, the resident physician, who kindly furnished the following notes:

Post-Mortem Examination.—Body of poorly nourished man. Rigor mortis absent.

Chest.—Both lungs markedly emphysematous. The right lung adherent in many areas, anteriorly and posteriorly. A few pleural adhesions of left lung.

Left Lung.—Seat of fibroid degeneration at apex involving pleura and few scattered patches beneath it; otherwise negative.

Right Lung.—At apex the pleura is slightly thickened, and at this area the lung has undergone fibroid degeneration. In the posterior portion of the middle lobe there is a hard mass the size of a small orange, dirty white in color, tough, and resistant on section. Bronchi in neighborhood of growth filled with reddish, mucopurulent casts. Bronchial glands in the region are enlarged and hard.

Heart.—There is slight thickening of the aortic valve; otherwise negative.

Liver.—Seat of slight fibroid change more marked at its edge, which is quite sharp.

Spleen.—Normal in size and is the seat of yellowish-white growth, occurring on its anterior aspect and curling over edge of organ, one inch in thickness, very resistant on section, with areas of chalky deposit. There are also numerous small fibromatous nodules scattered over surface of spleen, many of which are chalky.

Pancreas normal.

Stomach and Intestines normal.

Mesenteric Glands slightly enlarged and infiltrated.

The pathological sections were examined by Dr. Simon Flexner, who kindly gave me the following notes:

(1) *Lung* with tumor nodule; tumor circumscribed; separated by fibrous capsule from lung tissue; capsule infiltrated with numerous small round cells; tumor proper composed of strands of spindle cells with elongated, spindle-shaped nuclei and distinct nucleoli. There are scattered irregularly among these main tumor cells larger cells with several or numerous nuclei; nuclei are sometimes peripherally, at others centrally placed in protoplasm, and in general they are superimposed. They are not uniformly distinct among other cells, are more numerous in some areas and rare in others. Blood-vessels of tumor are imperfectly developed, having thin walls. A microscopical area of coagulative necrosis in centre of tumor.

(2) *Apex* of lung. Section includes thickened pleura and adjacent lung substance. There is coal pigmentation with thickened tissue and focal accumulation of round lymphoid cells; alveoli are emphysematous.

(3) *Liver Capillaries* in general are dilated. No increase in connective tissue of liver generally, but the capsule shows irregular thickening: new tissue penetrating a short distance into liver tissue; in this there is moderately rich new formation of bile ducts.

(4) *Spleen*. Splenic tissue not especially altered. In places the pulp contains a great deal of blood. Malpighian bodies are strikingly apparent; the capsule is thickened throughout, but not uniformly.

The thickened capsule consists of dense hyaline, almost cartilaginous, connective tissue. No tumor present.

Bronchial lymph glands contain much anthracoid pigment, which is present especially in the lymph cords and the endothelial cells of sinuses, and only rarely in the lymph nodes. There is no evidence of tumor in the sections examined.

Kidney. Section shows only some contraction of glomerule and increase of capsular space. No increase in connective tissue and no special degeneration of epithelium. No tumor.

Tumor. Composed chiefly of spindle cells, and contains a moderate number of giant cells of the megacaryocytic type.

VESICAL CALCULI DUE TO LIGATURES AND BONE SPICULE IN THE BLADDER.

DR. JOHN B. ROBERTS reported that a year ago a patient was brought to him for a urinary fistula in the anterior abdominal wall. She had been recently operated on in a distant part of the State for what was supposed to be extra-uterine pregnancy. The fistula formed before the wound healed, and closed spontaneously under Dr. Roberts's care. She came to him about a year after the operation, complaining of vesical pain, and showed a little concretion that she had passed per urethram. It was about the size and shape of the little finger-nail, and from it a little piece of silk ligature protruded. The patient was suffering intensely with vesical pain.

He examined the bladder twice with a sound and found no stone, but thinking that there might be other calculi, and seeing that she had an active chronic cystitis with intense pain, he decided to make a vaginal cystotomy, so as to find any stones and give the bladder rest and drainage. As soon as he opened the bladder, he came upon a stone, about as big as the thumb-nail, which had a silk ligature attached to it. The ligatures used in preventing hæmorrhage at the time of the original operation had evidently ulcerated into the bladder and acted as nuclei for the phosphatic concretions.

He also mentioned a case operated upon about a year ago, in which he extracted a stone from a female bladder by vaginal cystotomy, and found that a spicule of bone was the nucleus. That woman had been shot in the right hip months before with a Winchester rifle. The shot wound in the hip was still suppurating; but it was the bladder symptoms that caused the

woman to seek surgical aid. She was very comfortable after the calculus was removed.

Dr. Roberts frequently explores the bladder with the finger introduced through the dilated urethra, but in this case, and some others, he prefers making a vaginal cystotomy, because it gives such free drainage and affords rest to the bladder for several weeks. One can do the cystotomy with cocaine with great ease.

VESICAL CALCULUS FOUND ABOUT A SILK LIGATURE.

DR. WHARTON said that he had operated upon a woman some four or five years ago for strangulated hernia. The patient did well after the operation, but developed some time afterwards—five or six weeks—symptoms of intestinal obstruction, due apparently to an adhesion of the gut in the hernial ring. He opened the abdomen and found this to be the case, very marked adhesion producing a kink of the intestines in the region of the internal ring. He tied off with heavy silk ligature and closed the wound, and heard nothing from the patient, who did well for a year. Then he heard that she had a great deal of irritation with her bladder. Finally he saw her, and she showed him a silk ligature, which looked very much like the one he had applied, covered with a phosphatic deposit, which she said had passed from her bladder.

REVIEWS OF BOOKS.

A TREATISE ON ORTHOPÆDIC SURGERY. By ROYAL WHITMAN, M.D., M.R.C.S. Philadelphia: Lea Brothers & Co., 1901.

It is not on the score of novelty that this treatise will appeal to its readers, but, in contrast to its predecessors, it has been stripped of all that is redundant and obsolete, and the portrayal and account of "curio apparatuses" is wisely omitted.

The spirit that pervades the work is best reflected by quoting from the preface. "Orthopædic surgery is especially concerned with the mechanics of the human machine, with its development, with its capacity at different periods of life under varying conditions," etc. And again, "Its most distinct advance in recent years has been towards the prevention of deformity, an advance made possible by the better understanding of its predisposing and exciting causes." In harmony with these expressed views is the account—rendered for the first time in an English system of orthopædics—of Wolff's law, "Functional Pathogenesis of Deformity." This has grown to be the connecting link between the pathology and mechanics of orthopædia, and a very vital factor in imparting an additional scientific basis to an understanding of deformities.

While a keen sense of mechano-physics pervades these pages, yet, in the face of the relative repeated poor showing attending operative intervention in orthopædia, the author is not an absolutist for mechanical treatment. However, the operations are described rather sparingly, and not with that same acumen displayed in detailing a choice of apparatus. In this latter connection, the indications for and the purposes of appliances are exhaustively set forth, and the author gives play to a very liberal criticism justified by his wide experience.

A chapter devoted to the general considerations in the construction of all apparatus might have been incorporated; a like deficiency we believe to exist in the absence of a chapter on statical laws correlated with the physiological function of joints in general, though this matter is subjoined in the consideration of each joint affection. Finally, the scattered remarks as to the value of X-rays, very soberly judged, would have been more telling in a separate chapter. We grant, though, that such additional chapter would have entailed much repetition, from which the book is admirably free. The succession of chapters is based on the "relative importance in actual work of clinics," *i.e.*, to say in the order of natural development of this specialty, beginning with Pott's disease and terminating with tendon transplantation and arthrodesis. A uniform degree of thoroughness characterizes each chapter; yet we do not believe that, in the consideration of the less common tuberculous joint affections of the wrist, elbow, and shoulder, the author has done either the subjects or himself due justice. An abundance of practical teaching will be found in chapters on Pott's Disease and Hip-joint Disease, and as very original may be classed the chapters on Coxa Vara and Disabilities and Deformities of the Foot.

In directing attention to what may be regarded as innovations, we note that the heavy gymnastics advocated by Teschner are accorded a foremost consideration as meritorious; and yet the author subsequently retracts, because they can only be executed effectively by a physician. This exception alone would relegate this treatment to the select few as the best. The Côté method of forcible correction of the gibbous is advocated with great conservatism, and Goldthwaite's less violent gradual correction is preferred. No personal opinion is conveyed by the account of Bier's method of passive congestion; nor does the author, rightly so, hold in high esteem the iodoform injection treatment of joints. The utterance as to Lorenz's bloodless method is strongly in its favor; it being regarded as the easiest

and safest procedure that can be earliest applied to reduce or better the congenitally dislocated hip.

Mention of the rarer affections is not omitted, and their description, though brief, is supplemented by references to the original literature. Under the description of Charcot joint, we note that it is attributed to locomotor ataxia solely. We know at the present day that such types of joints may accompany other spinal cord diseases, yet none of the other spinal arthropathies are mentioned.

Syphilitic joint affections are treated, as is wont to be the case in orthopædia, with too little dignity, and the description must be regarded as inefficient. There is ample evidence on each page that the literature of all countries has been consulted and credited, and the array of statistics is elaborate and impartial. The illustrations, with very few exceptions, are original, well-posed, and executed.

In the matter of apparatus, the author exhibits an eminently practical and commendable tendency by dwelling on simple and non-costly, yet efficient, forms; this is the more noteworthy since the subjects of orthopædic surgery occur most often in those who are least able to bear the cost of expensive apparatus.

Judged in its entirety, this volume deservedly merits a wide circle of readers by virtue of its thoroughness, practicability, and impartiality.

MARTIN W. WARE.

A PRACTICAL TREATISE ON FRACTURES AND DISLOCATIONS. By LEWIS A. STIMSON, M.D., LL.D., Professor of Surgery in Cornell University Medical College, etc. Third edition. Octavo, 842 pages, with 336 illustrations and 32 full-page plates. Philadelphia and New York: Lea Brothers & Co., 1900.

This work originally appeared in two volumes, which were largely rewritten and published as a second edition in a single volume in 1899. The very favorable reception of the work in

its new form has given the author the opportunity to again revise and enlarge it, and to present a third edition in a little more than a year after the second. The new edition forms a volume of the same convenient size as its predecessor, the changes made having added but a few pages of text and twelve full-page plates. More prominent type has been used in headings and sub-headings, which assists the eye and adds to the appearance of the page.

Among the additions, injuries to the spinal cord are discussed at greater length, in connection with fractures and dislocations of vertebræ. It is the author's belief that most cases recovering after severe injury to the cord, whether operated on or not, are cases of hæmatomyelia. Therefore the recognition of this condition should be most carefully sought, as being of great importance in prognosis, and deterring from active surgical interference. The symptomatology of hæmatomyelia is concisely presented. The author still inclines strongly towards the systematic use of traction and the plaster jacket in fractures of the spine, and limits operation to a very small proportion of cases.

A description is given of the author's new method for the reduction of anterior dislocation of the shoulder by gentle continuous traction, and an excellent illustration makes the method at once plain. A procedure so simple and painless, accompanied with such excellent results as the author reports, should be widely known and practised. This method is similar to that long used by the author in the reduction of dorsal dislocation of the hip by traction furnished by the weight of the limb itself. A new illustration shows at a glance just how the latter method should be carried out.

The plates added include a number of very interesting skiagrams, although the author rarely receives information of practical importance from the X-ray in fractures which could not be obtained by other means.

Dr. Stimson's work will undoubtedly still continue to hold its place among the best treatises on this subject in the English

language. It displays wise and conservative judgment formed under exceptional opportunities for observation. Yet, in spite of the general excellence of this standard work, we would have been glad to see a new edition more fully embody American experience and practice up to date. The review of the preceding edition in the *ANNALS OF SURGERY* pointed out the fact that the author's statistics were drawn almost entirely from foreign writers, particularly Gurlt, instead of from the recent experience of our large American hospitals. A few general statistics from the author's service in the Hudson Street Hospital are brought to date in the present edition, but the remainder are largely those published abroad from twenty to fifty years ago. Interesting and valuable as these latter may be, the recent results of our own great hospitals would be of much more value to the surgeon of to-day; and Dr. Stimson's exceptional qualifications and opportunities place him in a position to best present such data. The active surgeon, too, would have found a larger discussion of the operative treatment of fractures profitable; although it is undoubtedly well that conservative opinions, such as the author's, be emphasized in a work of limited size, intended to reach the profession generally. For the general practitioner it is an excellent practical work, and for the student a standard book of reference.

RICHARD W. WESTBROOK.

DIE ENTZÜNDLICHEN ERKRANKUNGEN DES DARMS IN DER REGIO ILEOCAECALIS UND IHRE FOLGEN. Eine Studie aus der Praxis für die Praxis. Von DR. RICHARD LEUZMANN. Berlin: August Hirschwald, 1901.

Leuzmann's work on appendicitis and its sequelæ is a good one,—too good to be passed without criticism. If the book was read by any one unacquainted with the literary history of appendicitis and its treatment, he would come to the conclusion that practically nothing had been contributed to our knowledge in

this field by any professional brother outside of Germany. The principal, and perhaps only, references to non-German work are a mention of McBurney's point (*sic.*) and a punning reference to those surgeons, especially the French and Americans, who, knife in hand, invade the belly whenever the appendix grumbles. Leuzmann is evidently a good surgeon, but totally ignorant of foreign literature. The absence of the names so familiar in all our works on appendicitis is delightfully refreshing, but is unjust to those to whom honor is due.

The chapter on the etiology and pathological anatomy of appendicitis and its sequelæ is excellent and worthy of careful perusal. In one important point the author lays himself open to criticism. In his opinion (p. 18), the *larger* the communication between the appendix and the cæcum the more opportunity is there for the entrance of morbid material into the former, and the more favorable are the conditions for the occurrence of appendicitis. The above view is totally at variance with the experience of American surgeons, who find that stricture or obstruction of the appendicular lumen near the cæcum by hindering the evacuation of its contents and secretions is one of the principal causes of disease. The bacterial causes of appendicitis are practically always present in the organ; the entrance of more of them through a very patent cæco-appendicular orifice is of no moment, as the same patent orifice permits of free drainage into the large gut. It may be noted that the author makes no mention of appendicitis obliterans.

Metastatic foci of inflammation may be formed from morbid material carried along three routes,—the blood, the chyle, and the lymph. In discussing the above, the author makes a very valuable statement, viz., that septicæmia may occur from an appendicitis which has only insignificant symptoms; the poisons are taken up from the appendix by the chyle ducts and gain access to the blood through the thoracic duct. This explains the genesis of many cases of so-called cryptogenetic septicæmia.

The standard of excellence attained in the chapter on pathology is so uniformly high that it is difficult to pick out sections for special mention.

In making a diagnosis, the author propounds the following questions:

(1) Is appendicitis present? If so, of what pathological variety is it?

(2) Is there any circumscribed peri- or paratyphlitic exudate?

(a) Is this exudate due to appendicitis? if so, to what variety? Is the exudate the result of one of those rare cases of specific ulceration of the cæcum?

(b) Is the exudate serous or serofibrinous? Does it show evidences of suppuration? if so, is the suppuration pure or gangrenous? Is the exudation capable of resolution?

(3) Is the exudate reliably circumscribed? or are its boundaries weak? Is there any tendency to spread?

(4) Is the inflammatory process diffuse? Does it diffuse itself by continuity or by metastasis?

The author emphasizes that in many grave cases exudates, while present, cannot be demonstrated by palpation and percussion; under such circumstances one must trust to the symptoms, viz., the general condition of the patient (mental state, appetite, general malaise, sleep), the temperature, pulse, local pain, and meteorismus.

The author formulates his opinions as to treatment under the captions, "the absolute indications for internal treatment" and "the absolute indications for surgical treatment."

The cases which ought to be treated conservatively are:

(a) Acute appendicitis, with little fever, no marked general symptoms, no marked acceleration of the pulse. Such cases will usually improve in twenty-four hours.

(b) Serofibrinous appendicitis [Typhlitis stercoralis of the older writers] which runs its course with slight fever, quiet pulse,

moderate pain, and clear and well circumscribed exudate. Such cases show signs of resolution in from four to five days.

(c) Chronic forms of appendicitis resulting from repeated attacks of catarrhal appendicitis, or which are chronic *ab initio*, are not to be operated upon so long as the surgeon can only feel the appendix as a sausage-shaped tumor which shows no adhesions to neighboring structures, and gives no trouble except occasional attacks of pain and tenderness. If severe pain is present, operation is advised.

Operation is indicated under the following circumstances:

(a) When the exudate around the appendix has suppurated.

(b) When no exudate can be demonstrated, and yet in the second week the fever continues, the pulse becomes more rapid and flatter, the general condition is disturbed, tenderness increases, pain is perhaps present during urination, one may conclude that pus is present; and if symptoms develop showing the suppuration to be "malignant" in character, then operation is absolutely indicated. As symptoms of "malignant" suppuration may be mentioned (1) Increase of fever, perhaps with rigors, very rapid and soft pulse, stupor. (2) Increase of pain, accompanied by fever and beginning meteorism indicative of the spread of the suppuration to fresh regions of the peritoneum. The author, rather naïvely, remarks "in such cases we, unfortunately, are often too late with our operation, therefore, as a precaution, this absolute indication should be anticipated."

(c) When a specially virulent inflammation arises in the cæcal region with symptoms of perforation, and without any circumscribing exudation, immediate operation is indicated.

(d) Peritonitis (more or less general) resulting from perforation of the appendix or of an abscess wall calls for operation.

(e) Immediate operation is indicated in every case where marked ileus accompanies or results from appendicitis, the threatening symptoms being heart failure, facies abdominalis, etc.

(f) If in the course of acute appendicitis or of an acute ex-

acerbation in chronic appendicitis, grave symptoms arise, operate, as there is danger of gangrene. Such symptoms are: duration of the disease for more than three or four days, marked fever, rapid, flat pulse, nausea, general malaise, anorexia, heavily-coated tongue, marked tenderness at McBurney's point.

(g) Secondary collections of pus in various regions may be the occasion for operative interference.

In discussing the "relative" indications for operation where there is perityphlitic exudation, the author writes, "As a result of my experience, I recommend operation not later than the end of the first week in cases where the fever remains at 39° C. (102.2° F.), while the pulse becomes very rapid (110-120), and the local tenderness remains *in statu quo*, or becomes worse. I know that even in such cases resolution can take place, but I would only trust to this if I was in a position to recognize the exact condition of the exudation by means of careful physical examination, *i.e.*, when the exudation lies near the abdominal wall. If, under such circumstances, the exudation even increases, but remains firm and well circumscribed, then I can delay operation until symptoms, *e.g.*, fluctuation, show that resolution is impossible, or until a diminution of the exudation and fever manifests itself and the patient is spared surgical interferences."

We have purposely given a rather extended view of the author's opinions as to the indications calling for operation, as it is useful to note the stand-point of one so evidently ignorant of our literature. The author looks through his own spectacles, and the opinions of an independent observer are always worth studying.

While few, if any, surgeons are open to the scoff that they cut out every appendix "as soon as it grumbles," yet to us it appears that the extreme conservatism of the author is almost as dangerous as would be the fierce radicalism which he imputes to the French and Americans. When an appendix has shown its vulnerability to disease by exhibiting two or more attacks of ap-

pendicitis or by becoming chronically inflamed, then, whether adherent or not, it is far better in a bottle than in the belly. To leave such an organ untouched, as the author advises, is in our opinion bad surgery. The extracts and abstracts of the author's opinions which have been already given speak for themselves. The chief value of Leuzmann's work lies in his excellent though incomplete account of the pathological anatomy of appendicitis and of the relation between the anatomical conditions and the symptoms. Perhaps some of our criticisms may be harsh, but the general excellence of the work is such that it is quite capable of flourishing under candid criticism.

JOHN F. BINNIE.

CHIRURGISCHE KLINIK DER NIERENKRANKHEITEN. By Professor Dr. JAMES ISRAEL, of Berlin. Octavo, 615 pages, with 15 lithographic plates and 8 cuts in the text. Berlin: August Hirschwald, 1901.

This latest work of Israel's on the surgery of the kidney and ureter is in line with several other works on this subject by the same eminent authority. While claiming to be only the result of the author's observation during the past sixteen years, his experience has been so extensive that it is practically an exhaustive treatise on the subject.

The plan of the work is to present each topic in a complete manner, giving minute classifications; details of pathology, diagnosis, symptoms, and treatment, and making extensive use of statistics. Each chapter contains a report of several cases illustrating some point under discussion. In this way a total of 296 cases are reported in full, and all statements are supported by reference to these cases.

There are seventeen chapters, presenting the following subjects: Congenital Anomalies of the Kidney; Floating Kidney; Wounds of the Kidney; Pyelonephritis and Abscess of the Kid-

ney; Hydronephrosis; Pyonephrosis; Renal, Pararenal, and Parapelvical Cysts; Renal Tuberculosis; Renal Syphilis; Renal Actinomycoses; Kidney and Ureteral Stones; Anuria and Oliguria; Hæmatinuria, Neuralgia, and Colic in apparently unchanged Kidney; Malignant Tumors; Polycystic Degeneration of the Kidney; Diseases of the Ureter; Inflammations of the Fatty Capsule of the Kidney.

The illustrations consist of eight small wood-cuts in the text and fifteen well executed lithographic plates at the end of the volume.

The size of the work is too large to admit of a detailed account of the views expressed, but in general they are conservative, in accord with accepted surgical teaching, and are a safe guide to follow.

Nephropexy for floating kidney without hydronephrosis he thinks is a short-lived fad, practised upon neurasthenical women for the benefit of the surgeon rather than the patient. The class of patients that formerly went to the gynæcologists to have their ovaries removed now go to the surgeon to have their kidney sewed up. When these cases have symptoms referable to the kidney, they can be relieved by a suitable abdominal support, and are no longer operated upon in his clinic.

In opposition to Guyon, Israel holds the view that tuberculosis of the kidney is not infrequently a primary disease, and these cases are suitable for nephrectomy. In neoplasms of the kidney but little dependence can be placed upon the cystoscopic examination of the mouth of the ureters, but must be diagnosed by increased volume of the kidney, particles of tumor tissue in the urine, or an exploratory operation. In removing the tumor, the entire fatty capsule should be taken away, as it frequently contains cancer cells.

In the treatment of abscesses of the kidney and pyonephrosis, nephrectomy is usually to be preferred to nephrotomy, owing to the failure of the later operation to cure the disease, and the

danger attending prolonged suppuration and a secondary nephrectomy.

The work follows the traditions of the best German writers in its careful analyses of cases and fulness of details, and can be consulted with profit by any one interested in the surgery of the kidney.

GEORGE R. WHITE.

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A CONTRIBUTION TO THE PATHOLOGY, DIAG-
NOSIS, AND TREATMENT OF SUB-
PHRENIC ABSCESSSES AFTER
APPENDICITIS.

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MORE than two decades have elapsed since the publication by Leyden¹ of his classical paper on subphrenic abscesses, a publication which called the attention of the entire medical world to this subject. In 1894 Maydl² published a monograph in which he divided subphrenic abscesses into twelve classes according to their anatomical cause. Among these he described a series of twenty-five cases which were secondary to perityphlitic inflammation. In the following year Sachs³ collected and reported forty-one cases secondary to appendicitis. In this report he included Maydl's twenty-five cases, two of which, however, he ought to have excluded, because the autopsy showed in both cases perforation of the cæcum by foreign bodies (Cases II and III of Maydl). About one year ago, Weber⁴ reported nine cases of subphrenic abscess after appendicitis from the clinic of Sonnenburg, two of which had already appeared in the statistics of Sachs, and recently he has recorded six further cases. Mention of this complication of appendicitis is frequently made in the many monographs and papers on diseases of the vermiform appendix, and a number of cases are to be found in journal literature.

The importance of this complication of appendicitis is not, however, generally recognized. It has seemed to me, therefore, that a collection and study of all the recorded cases might be of

some value. I have been able to find only seventy-one cases in medical literature. Many had to be excluded because the reports were meagre and incomplete. To these seventy-one cases I have added two that have come under my own observation. The histories of these two cases are as follows:

CASE I.—*Acute Gangrenous Appendicitis; Appendectomy; Subphrenic Abscess; Transpleural Incision and Drainage; Cure.*—I. H., twenty-four years of age, gives typical history of acute appendicitis of four days' standing. Admitted and operated on August 15, 1900. Abscess containing foul pus opened and a totally gangrenous appendix removed; abscess cavity drained.

August 17. Jaundice; tenderness over the hepatic region; liver extends one inch below the free border of the ribs; the patient is apathetic and at times delirious.

August 21. Sensorium is clear to-day; jaundice is less marked; there is no longer any tenderness over the lower part of the right chest; posteriorly the liver dulness is enlarged upward and extends as high as the fourth rib in the scapular line; breathing and voice can be heard as low as the seventh rib behind. Temperatures between 100° and 103° F.; pulse 90 to 110. "Litten phenomenon" not present.

August 31. Temperature, 103° F.; pulse, 90; physical signs about the same as when last noted. The patient's general condition has remained practically unchanged for the last ten days; posterior hepatic region aspirated through the eighth intercostal space in the axillary line and foul pus withdrawn.

Operation.—Three inches of the ninth and tenth ribs resected in the axillary line; aspiration through the diaphragm showed that the pus was located under the dome of the diaphragm, and the needle had to enter two and one-half inches before the abscess cavity was reached; pleura incised and costophrenic sinus found obliterated by adhesions; diaphragm incised and large quantity of pus evacuated; cavity drained. Convalescence was uneventful, although the wound healed very slowly. A sinus persisted for some time, but had closed when the patient was discharged cured on October 23, 1900. (See "Mount Sinai Hospital Reports," Vol. ii, 1901, Report of the Second Surgical Division of Dr. H. Lilienthal, page 411.)

CASE II.—*Subacute Catarrhal Appendicitis; Subphrenic*

Abscess; Transpleural Incision and Drainage; Empyema; Drainage of Pleural Cavity; Sinus after Empyema; Thoracoplasty; Cure.—N. S., twenty-three years of age, transferred from the medical service of Dr. H. W. Berg and operated on August 10, 1900. Three weeks ago the patient began to have pain in the right side of the abdomen and over the liver, with fever; no cough or expectoration. The pain in the lower part of the abdomen disappeared in a few days, while the pain in the region of the liver became more severe. When he was admitted to the medical service, the physical examination of the chest revealed the following:

July 26. Liver dulness begins at the fourth space and flatness at the level of the sixth rib in the mammary line; the liver extends one finger's-breadth below the free border of the ribs; behind, over the right side of the chest, there is slight dulness at the base, with diminished voice, breathing, and fremitus.

July 30. There is tenderness on percussion and palpation in the axillary line over the area of liver dulness; marked resistance to palpation in the right hypochondrium; aspiration through the eighth interspace in the postaxillary line negative.

August 1. Since admission the temperatures have fluctuated between 99°-100.8° F. in the mornings to 103°-104° F. in the evenings; pulse, 76-98; respirations, 20-32; slight jaundice since one day; aspiration of the right hepatic region again negative.

August 4. Tenderness over the flat area in the axillary line is much increased.

August 6. Aspiration again negative. No "Litten phenomenon."

August 9. On the right side the level of flatness now extends up to the sixth space in the axillary line; in the scapular line it extends two inches above the angle of the scapula. Temperature is fluctuating as before. Aspiration in the axillary line through the eighth intercostal space gives pus, which on microscopical examinations does not show any liver elements.

August 10. *Operation.*—Three inches of the ninth and tenth ribs resected in the axillary line and lower pleural limit and upper surface of diaphragm exposed. As the exploring needle had shown that the pus was deeply situated near the median line, a small incision was made in the pleura at the same time that upward pressure was made on the liver. The diaphragmatic was then sewn to the costal pleura and the upper part of the wound

carefully protected with gauze. Aspiration through the diaphragm gave pus. With the needle as a director, a small incision was made through the diaphragm and a large amount of foul-smelling pus evacuated. The abscess cavity which extended over the greater part of the upper surface of the right lobe of the liver was drained with tubes. The patient stood the operation well, but convalescence was slow and was delayed by a secondary empyema. This was drained through the original pleural incision. By October 4, the subphrenic wound was entirely healed; but there was a continual profuse discharge from the pleural sinus, which was fully six inches long, and at its upper end opened into a cavity into which five ounces of fluid could be injected.

November 6. Thoracoplasty (Estlander); portions of eight ribs resected and large cavity exposed and packed. Convalescence was thereafter uninterrupted, the large wound healed slowly by granulation, the wound was closed, and the patient was discharged cured on January 9, 1901.

Frequency.—Among 179 cases of subphrenic abscess collected by Maydl twenty-three were secondary to appendicitis. Lang⁵ found twenty-six among 176 cases of right-sided subphrenic disease, and Sonnenburg observed nine subphrenic abscesses among 600 cases of appendicitis. In 350 of the patients there was an abscess around the diseased appendix, and nine of these patients had right-sided subphrenic abscess ($2\frac{1}{2}$ per cent. of the abscess cases). I have operated upon two patients for subphrenic abscess among ninety-one cases of appendicular disease that have occurred within the past year on the surgical service of Dr. Howard Lilienthal at Mount Sinai Hospital.

Subphrenic inflammatory processes secondary to disease of the vermiform appendix may occur in one of three ways:

(1) As a localization in the right or left subphrenic region of a general systemic infection,—the infectious agents being carried to the subphrenic region by the blood current. Here the process is secondary to a generalized infection, and hence is not considered in this paper.

(2) As a localized abscess formation in the right or left

subphrenic region, a part of a general purulent peritonitis with foci of suppuration in various parts of the abdominal cavity. This variety is infrequent, as the patients generally die before encapsulation of the abscess can occur.

(3) As a local process by direct extension, or through the lymph channels, from disease in or around the vermiform appendix. This is the most frequent variety, and the one with which we are here concerned.

Anatomy.—The right subphrenic region may be considered to be bounded above by the diaphragm, below by the liver, to the left by the falciform ligament of the liver, in front to the right and posteriorly by the abdominal parietes. The right kidney and its suprarenal capsule lie partly within and partly in front of and below this region. The liver with its peritoneal covering forms the lower boundary of the space, except where it is adherent to the diaphragm and uncovered by the peritoneum, where it forms the anterior boundary.

According to Fränkel,⁶ inflammatory processes in this region may lie entirely within the peritoneal cavity or outside of it. The intraperitoneal variety is usually the result of the direct extension of the inflammatory process from below, although it is sometimes impossible to demonstrate a direct communication between the subphrenic abscess and the abscess in the ileocaecal region. In this variety the inflammatory process may extend upward along the anterior, outer, or inner side of the colon or kidney. In the extraperitoneal variety the process advances by the retroperitoneal route, behind the ascending colon and kidney. The abscess generally lies behind and above the kidney and, unless very large, causes little or no downward displacement of the liver. The peritoneum covering the diaphragm is very intimately connected with the muscle substance (Hofmann, A. Schmidt, etc.), so that it is not easily separated from the muscle by collections of fluid beneath it. Hence perforation of the diaphragm or bulging in the lumbar region is apt to occur early in the extraperitoneal variety. Weir⁷ believes that the extraperitoneal form is very rare. In the seventy-three cases I have collected, the abscess was extraperi-

toneal in twenty cases (27 per cent.), intraperitoneal in thirty-five (48 per cent.), the anatomical location doubtful in eighteen cases (25 per cent.).

The inflammatory process does not always go on to supuration. There may be only a perihepatitis with exudation of fibrin and the formation of adhesions between the contiguous surfaces of the liver and diaphragm. Every physician who has seen a number of cases of appendicitis must have met with this affection, but altogether too little weight has been laid upon it as an early sign of upward extension of the inflammatory process. Lapeyre⁸ has recently published a very interesting paper on pleurisy secondary to appendicitis, in which he shows that perihepatitis is an early stage of subphrenic abscess. He believes that perihepatitis will be more often found if carefully looked for. Lapeyre believes that most of the cases of pleurisy and empyema that follow inflammatory affections of the ileocæcal region are secondary to an infectious perihepatitis, the infectious agents being carried through the lymphatics which connect the right subphrenic space with the right pleural cavity (Recklinghausen,⁹ Tilger,¹⁰ etc.). Cases of this kind run a characteristic course, of which the following is an example:

L. F., twenty-two years of age, was operated on by me on September 3, 1900, in her second attack of acute appendicitis. The attack was of four days' standing. There had been slight general tympanites and general abdominal tenderness during the twenty-four hours before operation; temperature, 101.2° F.; pulse, 108. The mucous membrane of the appendix was deeply congested and contained several small ulcers. The appendix was removed and the abdominal wound closed without drainage. On the second day the temperature sank to normal, and convalescence was uninterrupted until the tenth day, when the patient began to complain of pain over the region of the liver, and the temperature began to rise again.

On the eleventh day there were numerous friction râles over the hepatic region; the temperature rose to 103° F., and the pulse to 120. There were no symptoms that would indicate an affection

of the right pleural cavity; physical examination was absolutely negative.

On the sixteenth day the pain over the liver was much less; but the patient now began to complain of pain over the right scapula. The friction sounds over the liver anteriorly had now entirely disappeared, but there was slight dulness over the lower part of the right chest posteriorly, with diminished breathing and voice over the ninth and tenth ribs behind. The wound in the right iliac region was firmly healed. The liver and pleural cavity were aspirated with a negative result.

On the nineteenth day after operation aspiration of the right pleural cavity was again negative. On the twenty-first day the dulness on percussion posteriorly extended as high as the sixth rib, with diminished breathing and voice over the same area. Physical examination of the right chest in front was entirely negative.

On the twenty-fourth day the right chest was aspirated through the seventh intercostal space in the axillary line and twenty ounces of clear serum withdrawn. Within twenty-four hours the temperature and pulse had fallen to the normal, and convalescence was thereafter uninterrupted.

In this patient an acute attack of appendicitis was followed by a perihepatitis, and later by a pleurisy with effusion. The signs of the perihepatitis disappeared within a few days, while the signs of the pleurisy persisted until the exudate was withdrawn.

In the large majority of the patients the supphrenic affection is secondary to a suppurative inflammation in or around the appendix. Sonnenburg¹¹ is undoubtedly mistaken when he declares that these subphrenic affections are always preceded by a suppurative inflammation in the right iliac region. Of the seventy-three cases that I have collected, there was an abscess in or around the appendix in fifty cases (68 per cent.), no abscess in seven cases (10 per cent.); in the other sixteen cases no details were given.

When the subphrenic inflammatory process is caused by direct extension from below, its position varies with the location of the diseased appendix. Of the seventy-three cases, the

appendix lay behind the cæcum or ascending colon in seventeen patients (23 per cent.), in front of or below the cæcum or colon in twelve patients (16 per cent.); details were wanting in forty-four patients (61 per cent.). If the appendix lies in front of or to the inner side of the cæcum or colon, the inflammatory process extends upward in front of or along the inner side of the colon to the dome of the diaphragm. If the appendix lies behind the cæcum, it may become walled off from the general peritoneal cavity by adhesions, so that it is practically extraperitoneal. If such be the case, the inflammatory process extends upward behind the ascending colon and kidney to the diaphragm. There may be an extraperitoneal abscess behind the cæcum, although the appendix or its diseased part lies within the general peritoneal cavity. In these patients there may be an extraperitoneal subphrenic abscess, although the inflamed appendix lies intraperitoneally, or *vice versa*. (See Cases 43 and 50.)

The size of the abscess cavity and the amount of pus it contains vary within wide limits. In the extraperitoneal subphrenic abscess the quantity of pus is generally smaller than in the intraperitoneal variety, hence the latter are more apt to be recognized early. Depression of the liver and paralysis of the diaphragm occur more frequently and earlier in the intraperitoneal variety. The abscess cavity may contain fluid alone or both fluid and gas. The pus is generally thick and of a foul odor. In about 15 per cent. of the patients the abscess contains gas.

Perforation of the diaphragm occurred in 25 per cent. of the cases. In a number of these cases operative measures were long delayed or not instituted. With early diagnosis and operative interference, perforation of the diaphragm will probably be a rare occurrence.

Symptomatology.—The symptoms of subphrenic inflammation may come on days, weeks, or months after the appendicular disease or the operative measures instituted therefor. The greater the delay in opening the abscess or in removing the appendix the earlier will the symptoms of subphrenic disease

manifest themselves. In some cases, where the appendix is situated near the liver,—with a congenital absence of the ascending colon or where the cæcum is folded over on the ascending colon,—the primary appendicular abscess may at once invade the subphrenic region. On the other hand, with insufficient drainage of the abscess in the ileocæcal region or from secondary abscesses which were not discovered at the first operation, the subphrenic inflammation may occur weeks or months after the primary disease.

Several modes of onset are, however, characteristic.

(a) A few days after the acute symptoms of appendicitis have been relieved and the temperature has fallen to the normal, the patients begin to complain of pain in the lower part of the right chest, the temperature begins to rise, the area of liver dulness is found to be somewhat enlarged, there are friction sounds over the hepatic region, and tenderness in one or two intercostal spaces. There may be slight or well-marked jaundice. Within a few days the pain over the liver becomes less, while the signs of fluid become evident.

(b) Before the acute symptoms of appendicitis have entirely subsided, although the local symptoms are much improved, the daily temperatures begin to take on a remittent type, and the patients begin to lose flesh and strength rapidly. These patients look very ill from the beginning. They do not complain of much pain, although they may have tenderness in the lumbar region; the most marked symptom is the rapid loss of flesh and strength. No further physical signs may be discoverable until the bulging of the abscess in the lumbar region is found.

(c) After having recovered from the attack of appendicitis in a satisfactory manner, some of the patients never regain their former health. Without any change in the temperature, respiration, or pulse, the patients complain of continual slight pain in the right chest. The pain persists for weeks or months, physical examination and aspiration of the right chest result negatively. The patients never look very ill. After a varying length of time, the presence of fluid under the diaphragm, and

perhaps also in the pleural cavity, is discovered by means of physical examination and the aspirating needle.

Diagnosis.—A detailed description of the various symptoms and physical signs that may be present in this affection would occupy too much space, and would be of relatively little value; mention will be made of only the most important ones.

The first symptom of importance is the pain. The pain in the right hypochondrium may begin suddenly or gradually; it may be severe from the beginning. It is generally localized somewhere between the eighth and the eleventh ribs, between the mammary and posterior axillary lines. There may, however, be severe pain in the right scapular region. Soon after the beginning of the pain, physical examination of the hepatic region will reveal changes from the normal. There may be fine friction sounds in this region, or more or less extensive dulness or flatness on percussion over the area of relative liver dulness or over the lower ribs posteriorly. The dulness, if carefully watched, may be found to extend from day to day; it soon spreads beyond the area of normal liver dulness. At about this time, in the intraperitoneal form of subphrenic abscess, the liver will be found to have been pushed down, so that it can be felt one to two inches below the free border of the ribs. There may be little change in the respiratory murmur in the lower part of the right chest, or there may be diminished voice and breathing.

When the subphrenic abscess contains gas, the diagnosis is generally more easy, because of the obliteration of the liver dulness by full tympanitic resonance and because of the presence of succussion sounds. No matter what the position of the patient, this tympany will be found to be limited to the lower part of the right chest. With the demonstration of a collection of gas and fluid in the lower part of the right chest, the possibility of a subphrenic pyopneumothorax becomes almost a certainty, for acute pyopneumothorax after appendicitis and without previous physical signs of subphrenic disease has not been described, and must therefore be rare.

When the abscess does not contain gas, the question may

arise as to whether one has not to deal with an effusion into the right chest. Most of the errors in diagnosis that have been made have been along this line. Three conditions are possible: there may be an effusion into the pleural cavity, or there may be both a subphrenic and a pleural effusion, or there may be a subphrenic effusion alone.

The physical signs of pleurisy with effusion and of empyema need not be described here; mention will only be made of a few signs that are of value for differential diagnostic purposes. With a beginning pleural effusion there are more apt to be symptoms which point to an affection of the chest, —rapid respiration, cough, expectoration; the level of the dulness in pleural effusions is generally concave upward, and the upper border of the dulness changes distinctly with a change in the position of the patient.

When there is a well-marked effusion under the diaphragm there are usually no thoracic symptoms; the upper level of the dulness is a straight line or is convex upward; there is little change in the line of dulness with a change in the position of the patient. While in a pleural effusion the respiratory murmur is much diminished or absent below the level of the fluid, in subphrenic effusions the murmur can generally be plainly heard below the level of the fluid. Depression of the liver is frequent in subphrenic abscesses; it is rare in pleurisy unless the effusion be a very large one. The heart is never appreciably pushed to the right, nor are a number of the intercostal spaces bulged out in effusions under the diaphragm. The greatest difficulties in diagnosis are met with in the cases in which a pleurisy with effusion is associated with a collection of fluid underneath the diaphragm. When the subphrenic abscess contains gas, the diagnosis of the two associated conditions is possible. In the upper portion of the chest there are then the signs of pleuritic effusion, and below these the signs of an effusion containing gas. When the quantity of fluid in the pleural cavity is considerable, it may be impossible to make the diagnosis of a primary subphrenic abscess, except from a careful study of the patient's history and by means of the aspi-

rating needle. If pus is withdrawn by aspiration through one of the lower intercostal spaces and clear fluid by aspiration higher up, the diagnosis of an association of the two conditions is almost assured. When perforation of the diaphragm occurs, it is characterized by the sudden appearance of symptoms of invasion of the pleural cavity,—cough, rapid respiration, expectoration, and frequently sudden collapse. In a few cases the pleural space had become obliterated, so that the perforation occurred directly into a bronchus, the patient began to have a profuse and foul expectoration, and a cure resulted without operative interference. Such a fortunate outcome is, however, rare.

Litten¹² claimed that the so-called diaphragm phenomenon was a pathognomonic sign of subphrenic abscess. In several patients with collections of fluid beneath the diaphragm, he observed a well-marked depressed, undulating curve traveling downward along the side of the thorax during deep inspiration, and a convex prominent line moving upward during expiration. Some writers (Jendrassik,¹³ Chelchowski,¹⁴ etc.) declare that if it can be demonstrated that the dulness is absolutely limited above by the diaphragm line the diagnosis of subphrenic abscess is assured. In a large number of the patients with this affection, however, the diaphragm phenomenon was not present, while the diaphragm line has been found in many normal individuals. Up to the present time, therefore, it has little diagnostic significance.

According to Fürbringer,¹⁵ the motions of the aspirating needle introduced into the abscess are pathognomonic. Fürbringer claimed that during inspiration and expiration an exploring needle which had perforated into the subphrenic space would move in the opposite direction to what it would do if it were in the pleural cavity. The movements of the diaphragm are, however, often greatly impaired, especially when the diaphragmatic is adherent to the pulmonary pleura and the costophrenic sinus obliterated, so that the movements of the needle are little influenced by the diaphragm. Some authors have claimed that in subphrenic abscess the pus escapes from the

exploring needle most forcibly during expiration, while in paracentesis of the pleural cavity the fluid escapes most forcibly during inspiration. On account of the paralysis or limitation of motion of the diaphragm, this difference often does not exist. Sachs¹⁶ believes that singultus is a characteristic symptom of subphrenic abscess. This symptom, however, was present in only a few of the reported cases, and little value can be attached to it, since singultus frequently occurs in abdominal disease of any kind.

While the presence of one or more of the symptoms that have been described above may be of some value for diagnostic purposes, the absence of one or all of them does not mean that subphrenic abscess can therefore be excluded. In the majority of the cases the diagnosis has to be made from a careful study of all the signs and symptoms present.

Localized œdema over the lower part of the chest in front or behind generally means that there is a suppurative process somewhere in the neighborhood, and this œdema, if present, is of importance, since it shows that the abscess is approaching the surface of the body.

The differential diagnosis between subphrenic abscess and abscess of the liver is often very difficult and sometimes impossible before operation. In both affections the liver dulness is increased upward and downward and limited above by the diaphragm, in both is the lowermost level at which the respiratory sounds can be heard below the level of dulness; the clinical symptoms of liver abscess may be in all respects like those of subdiaphragmatic disease.

Abscess of the liver is, however, much more rare after appendicitis than is subphrenic abscess. Sonnenburg (*loc. cit.*) has seen but five cases in the same time that he observed fifteen cases of subphrenic abscess. There are a few minor points of difference that are worthy of mention. Pain in the right shoulder-blade is rare in the latter condition and frequent in the former. Paralysis of the diaphragm, and hence diminution or absence of respiratory movements of the liver, occurs far more often in subphrenic affections. Chills and profuse sweats are more frequent in abscess of the liver.

The final and positive diagnosis must be made with the aspirating needle, the puncture being made in the seventh to tenth intercostal space in the axillary line, unless there are signs of pointing in front or in the lumbar region.

The fluid obtained by aspiration should always be microscopically examined for liver elements. The characteristic pus of liver abscess is of a light chocolate color with little or no odor. Foul odor of the pus will generally mean subphrenic and not liver abscess, although the possibility of an hepatic abscess which has ruptured into the subphrenic region must be remembered. Foul odor of the pus may be due as well to mere proximity to the intestine as to direct or indirect communication with some part of the bowel.

Large perinephritic abscesses rarely bulge upward into the subphrenic region, but the previous existence of disease of the kidney, the location of the abscess, and the signs of a tumor in the region of the right kidney generally suffice to differentiate between these two affections. Occasionally, however, an extraperitoneal subphrenic abscess may give all the signs of a perinephritis.

Prognosis.—According to Maydl, the mortality after operations for subphrenic abscess is 35.7 per cent., and the general mortality of all cases is 56 per cent. Sonnenburg reckons that 55.5 per cent. of the unoperated cases die, while 42 per cent. of the patients operated on succumb to the disease. According to Sachs, 37.5 per cent. of the patients operated on die, while of the non-operated patients 71.5 per cent. die. Of thirteen cases operated on within three weeks from the beginning of the disease only 15.3 per cent. died, while of eight cases in which the operation was delayed for a longer period of time 50 per cent. died.

These figures are undoubtedly too high. In many of the patients the disease was allowed to run its course for weeks or months before operative interference, if any, was attempted. With improvements in our methods of diagnosis and operative treatment, the affection will surely be recognized and treated

at a more early date. Of the seventy-three cases I have collected, the total mortality was 40 per cent.

Died with operation, eleven cases.....	15 per cent.
Died without operation, eighteen cases.....	25 per cent.

Total mortality..... 40 per cent.

Cured with operation, forty cases.....	55 per cent.
Cured without operation, four cases.....	5 per cent.

Total cures..... 60 per cent.

Therefore of fifty-one patients operated on eleven died, a mortality of 22 per cent., and of twenty-two patients not operated on eighteen succumbed to the disease, a mortality of 82 per cent. In three of the four patients that recovered without operation the abscess was perforated and the pus discharged through a bronchus, in the fourth patient the subphrenic abscess cavity formed part of the original appendix abscess cavity.

Treatment.—Whenever, after an attack of appendicitis, symptoms of subphrenic inflammation appear, the first indication is to carefully examine the ileocæcal region in order to determine with certainty that the local conditions have been entirely relieved. If operation has been performed the wound should be examined, and if necessary freer drainage be established. If no operation has been performed, or if the wound be already closed, the right iliac and lumbar regions should be carefully palpated.

The treatment of the perihepatitis is a purely medical one and need hardly be considered in this place. As soon as the general symptoms or the physical signs warrant it recourse should be had to the aspirating needle, and immediate operative measures instituted when pus is obtained. When an abscess points below the free margin of the ribs or in the lumbar region it should be freely incised at an early date, the incision being made over the most prominent part of the swelling. If the exploring needle demonstrates that the pus is deeply situated

on the upper surface of the right lobe of the liver the abscess will have to be approached by one of two routes,—either by the resection of one or more of the lower ribs and incision of the abscess through the diaphragm but below the reflection of the pleura, or by the transpleural method, the approach to the abscess cavity being made through the intact pleural cavity and the diaphragm. The main advantage of the former of these two methods is that the pleura is not injured, and in the cases in which it is possible this method of operation is to be preferred. For abscesses of the liver situated under the dome of the diaphragm near the upper surface of the liver and for subphrenic abscesses in this location, Lannelongue¹⁷ advised that portions of the seventh to tenth ribs should be resected in the mammary line, and the abscess opened without injury to the pleura. Such extensive resections are seldom, if ever, necessary; sufficient room can generally be gained by the resection of one or two ribs. Sometimes the resection of one or two of the lowest costal cartilages in the mammary line, according to the method of Landau,¹⁸ will suffice.

In five cases of subphrenic abscess and in one of subphrenic echinococcus cyst of the liver, I have followed out the following method of operation, and the exposure of the upper surface of the liver was in all the patients a very good one.

About two inches of the ninth and tenth ribs are resected in the usual manner somewhere between the scapular and the anterior axillary lines, according as the exploring needle has revealed the pus located more anteriorly or posteriorly. The two ribs can be resected through one incision made in the intercostal space between them. After the ribs have been resected, the diaphragm with the liver moving below it will appear in the lowermost portion of the wound, and the pleural reflection will be seen in the upper part. If there is a suspicion that the pleural cavity contains pus, aspiration of the pleura should first be done. If pus be obtained, the cavity should be opened and drained at once. If aspiration of the pleura is deemed unnecessary or inexpedient (as is generally the case), the upper part of the wound should be carefully protected with gauze, and the

aspirating needle then made to perforate the diaphragm below the reflection of the pleura. If the needle enters the abscess cavity, it should be allowed to remain in place and be used as a director. A small incision of the diaphragm alongside of the needle, the dilatation of the small opening with the dressing forceps, and drainage of the abscess cavity with tubes according to general surgical principles, are all that is required.

The abscess cavity may, however, be situated so near the median line high up under the dome of the diaphragm that it can be reached only by the transpleural route. The pleural cavity can then be opened without further delay through the upper part of the wound. In some cases the costophrenic sinus has been entirely obliterated by adhesive inflammation, so that the pleura can be incised without opening the pleural cavity proper. If this be the case, great care must be taken not to tear the adhesions, as they are often very weak and easily separated. If the pleural cavity must, nevertheless, be opened, this should be done as rapidly as possible. An assistant should make upward pressure against the liver while the operator makes a small incision into the pleura. By means of upward pressure against the liver, it is often possible to so closely approximate the diaphragmatic to the costal pleura that little, if any, air can enter the pleural cavity when the opening is made. In one case of subphrenic abscess operated on by the transpleural route, it seemed to me that I succeeded in opening the pleural sac and sewing the diaphragmatic to the costal layer without the entrance of the slightest amount of air into the right chest. In most of the cases, however, one must remain satisfied when the quantity of air that enters the pleural sac is much limited by this little practical procedure. Sometimes it is impossible to unite the two pleural layers by suture, and all that can be done is to wall off the cavity carefully with gauze. Beck¹⁹ believes that aseptic tamponade of the pleural sac should always be done, and he claims that it is generally preferable to the suture. This has not, however, been the experience of the writer.

The incision of the diaphragm and the evacuation of the

pus by drainage of the abscess cavity are accomplished in the way that has already been described.

The writer has found the method of operation described above a very satisfactory one. The amount of injury done to the bony parts of the chest-wall is reduced to a minimum, at the same time that a good exposure of the field of operation is obtained. Through the lower part of the wound the diaphragm can be incised below the reflection of the pleura, while the upper part of the wound affords sufficient room for the approach to the abscess by the transpleural route. No especial originality is claimed for this operation; the writer believes, however, that it is the simplest and best method for the opening and drainage of deeply seated subphrenic abscesses and of some abscesses and echinococcus cysts of the liver which bulge into the subphrenic space.

TABLE OF CASES OF SUBPHRENIC ABSCESS AFTER APPENDICITIS.

No.	Author.	Condition of Appendix.	Position of Appendix.	First Symptoms after Appendical Operation.	Intraperitoneal or Extraperitoneal.	Kind of Operation.	Pleural or Pulmonary Complications.	Result.
1	Krohne. ²⁰	(?) No operation.	?	Thirty-second day.	Intraperitoneal.	Incision along free costal border, thirty-sixth day.	.....	Cure.
2	Weber (Sonnenburg). ²¹	Gangrene, abscess.	Retrocolic.	Fifth day.	?	Resection seventh rib axillary line, fifth day.	Empyema.	Death.
3	Weber (Sonnenburg). ²¹	Abscess.	?	Fifth day.	?	Resection ninth rib, ninth day.	Empyema.	Cure.
4	Weber (Sonnenburg). ²¹	Abscess.	?	?	Intraperitoneal.	No operation.	Pleurisy.	Death.
5	Weber (Sonnenburg). ²¹	Gangrene, abscess.	In front of colon.	Tenth day.	Intraperitoneal.	No operation.	Perforation and empyema.	Death.
6	Weber (Sonnenburg). ²¹	Perforation, abscess.	In front of cecum.	Twelfth day.	Intraperitoneal.	Incision along free costal border, sixteenth day.	.....	Cure.
7	Weber (Sonnenburg). ²¹	Gangrene, abscess.	?	Ninth day.	Extraperitoneal.	Resection eleventh rib, thirtieth day.	Secondary empyema.	Death.
8	Weber (Sonnenburg). ²¹	(?) No operation.	?	Eleventh day.	Extraperitoneal.	Resection ninth rib axillary line, fourteenth day.	Secondary empyema.	Cure.
9	Weber (Sonnenburg). ²¹	Abscess.	In front of cecum.	Tenth day.	Intraperitoneal.	Puncture sixth interspace on tenth day.	.....	Death.
10	Weber (Sonnenburg). ²¹	Gangrene, abscess.	?	?	?	Resection eleventh rib six months later.	Secondary empyema.	Cure.
11	Wanach. ²²	Gangrene, abscess.	?	Third day.	?	Transpleural, third day.	.....	Cure.
12	Baldwin. ²³	Chronic inflammation.	Retrocolic.	?	Extraperitoneal.	Incision below twelfth rib, thirtieth day.	.....	Cure.
13	Baldwin. ²³	Gangrene.	?	Twenty-first day.	Intraperitoneal.	Incision below twelfth rib, fourth week.	.....	Cure.
14	Herrlich. ²⁴	Gangrene, abscess.	?	?	Intraperitoneal.	Resection fifth rib.	.....	Death.

TABLE OF CASES OF SUBPHRENIC ABSCESS AFTER APPENDICITIS.—Continued.

No.	Author.	Condition of Appendix.	Position of Appendix.	First Symptoms after Appendic. Operation.	Intraperitoneal or Extraperitoneal.	Kind of Operation.	Pleural or Pulmonary Complications.	Result
15	Duchek.	Gangrene, abscess.	Retrocolic.	?	Intraperitoneal.	No operation.	Perforation and empyema.	Death.
16	Bruzilius-Key.	Gangrene, abscess.	Retrocolic.	3 (?)	Extraperitoneal.	No operation.	Perforation and empyema.	Death.
17	Bernheim.	?	?	?	Extraperitoneal.	No operation.	Perforation and empyema.	Death.
18	Jaffe.	Abscess.	Extracolic.	?	Intraperitoneal.	Incision through seventh space on second day.	.....	Death.
19	Lee-Murphy.	Gangrene.	?	?	Intraperitoneal.	No operation.	Perforation and empyema.	Death.
20	Koerte.	Abscess.	?	?	Intraperitoneal.	No operation.	.....	Death.
21	Koerte.	Abscess.	?	?	Intraperitoneal.	Resection seventh rib, eighth week.	.....	Cure.
22	Koerte.	Abscess.	?	?	Extraperitoneal.	Resection twelfth rib, thirteenth day, lumbar incision.	.....	Cure.
23	Koerte.	?	?	?	?	Resection eighth rib.	.....	Cure.
24	Koerte.	Abscess.	Retrocecal.	?	Extraperitoneal.	Resection eighth and ninth ribs.	Pleurisy.	Cure.
25	Koerte.	Abscess.	Retrocecal.	?	Extraperitoneal.	Lumbar incision.	Perforating bronchus.	Cure.
26	Eisenlohr.	Gangrene, abscess.	Retrocecal.	?	Intraperitoneal.	No operation.	Perforation and empyema.	Death.
27	Bamberger.	Gangrene.	?	?	Intraperitoneal.	No operation.	Perforating bronchus.	Death.
28	Bamberger.	Gangrene.	Retrocecal.	Seventh day.	Intraperitoneal.	No operation.	Perforation and empyema.	Death.
29	Lannelongue.	?	?	Seventh week.	?	Resection sixth and seventh ribs, eighth week.	.....	Cure.

30	Starcke.	?	?	?	?	?	?	?	Intraperitoneal.	No operation.	Perforating bronchus.	Cure.
31	Paetsch.	?	?	?	?	?	?	?	Intraperitoneal.	Incision seventh rib, fourth week.	Perforating bronchus.	Cure.
32	Audouard.	Abscess.	Retrocaecal.	?	?	?	?	?	Extraperitoneal.	No operation.	Perforation and empyema.	Death.
33	Lauenstein.	Abscess.	?	?	?	?	?	?	Intraperitoneal.	Incision below ribs.	.....	Cure.
34	Gruenbaum.	?	?	?	?	?	?	?	?	Resection sixth rib.	Perforation and empyema.	Death.
35	Nowack.	?	?	?	?	?	?	?	?	No operation.	Perforating bronchus.	Cure.
36	Koerte.	Abscess.	Retrocaecal.	?	?	?	?	?	Extraperitoneal.	Lumbar incision.	.....	Cure.
37	Coupland. ²⁵	?	?	?	?	?	?	?	Intraperitoneal.	Incision below twelfth rib.	.....	Cure.
38	Nothnagel. ²⁵	Gangrene, abscess.	In front (?).	?	?	?	?	?	Intraperitoneal.	No operation.	Perforation and empyema.	Death.
39	Weir. ²⁵	Abscess.	?	?	?	?	?	?	Intraperitoneal.	Incision below free border.	.....	Death.
40	Baginsky. ²⁵	Abscess.	In front.	?	?	?	?	?	Intraperitoneal.	No operation.	Perforation and empyema.	Death.
41	Roux. ²⁵	Abscess.	Retrocolic.	?	?	?	?	?	Extraperitoneal.	Incision fourth interspace.	.....	Cure.
42	Roux. ²⁵	Perforation, abscess.	Intracaeal and in front.	?	?	?	?	?	Extraperitoneal.	Incision fifth space, eleventh day.	Pleurisy.	Death.
43	Lauenstein. ²⁵	Chronic abscess.	In front of colon.	?	?	?	?	?	Extraperitoneal.	No operation.	.....	Death.
44	Gerhart. ²⁵	?	?	?	?	?	?	?	?	Resection fifth rib, fourteenth day.	Perforation and empyema.	Cure.
45	Frerichs. ²⁵	?	?	?	?	?	?	?	Intraperitoneal.	No operation.	.....	Death.
46	Sachs. ²⁵	Abscess.	?	?	?	?	?	?	Intraperitoneal.	Resection ninth rib.	.....	Cure.
47	Sachs (Kocher). ²⁵	Abscess.	?	?	?	?	?	?	?	Incision below twelfth rib.	.....	Cure.
48	Sachs (Kocher). ²⁵	Abscess.	?	?	?	?	?	?	?	Resection ninth and tenth ribs.	.....	Cure.
49	Sachs (Kocher). ²⁵	Perforation, abscess.	In front of cecum.	?	?	?	?	?	Intraperitoneal.	No operation.	.....	Death.
50	Cohen. ²⁶	Abscess.	Retrocaecal.	?	?	?	?	?	Intraperitoneal.	Resection twelfth rib.	Pleurisy.	Cure.

TABLE OF CASES OF SUBPHRENIC ABSCESS AFTER APPENDICITIS.—Continued.

No.	Author.	Condition of Appendix.	Position of Appendix.	First Symptoms after Appendicectomy Operation.	Intraperitoneal or Extraperitoneal.	Kind of Operation.	Pleural or Pulmonary Complications.	Result.
51	Baron. ²⁷	Chronic, no operation.	?	?	Intraperitoneal.	Resection eighth and ninth ribs.	Pulmonary abscess.	Death.
52	Baron. ²⁷	?	?	?	Intraperitoneal (?)	Incision along free costal border on sixth day.	.....	Cure.
53	Thyne. ²⁸	?	?	Three and one-half months.	?	Incision.	.....	Cure.
54	Loison. ²⁹	Abscess.	?	Ninth week.	Extraperitoneal.	Resection tenth rib scapular line, tenth week.	.....	Cure.
55	Jalaguier. ³⁰	(?) No operation.	?	Eighth day.	Intraperitoneal (?)	Resection ninth rib.	.....	Cure.
56	Grimm. ³¹	(?) No operation.	?	Twenty-eighth day.	?	No operation.	Perforating bronchus.	Cure.
57	Freiberg. ³²	Abscess.	Retrocolic.	Fourteenth day.	Intraperitoneal Extraperitoneal (?)	Resection tenth rib, seventh week.	.....	Cure.
58	Schlesinger. ³³	Chronic, no operation.	?	Seventh week.	Intraperitoneal (?)	No operation.	Pneumonia.	Death.
59	Hawkes. ³⁴	Abscess.	?	Forty-fourth day.	Intraperitoneal (?)	Incision below twelfth rib.	.....	Cure.
60	Hawkes. ³⁴	Abscess.	Retrocolic.	Tenth day.	Extraperitoneal.	Resection ninth and tenth ribs, tenth day.	Perforation and empyema.	Cure.
61	Lockwood. ³⁵	?	?	?	?	Incision below twelfth rib.	Empyema.	Death.
62	Lapeyre. ³⁶	Abscess.	Retrocecal.	Twelfth day.	Extraperitoneal.	?	.....	Cure.
63	Straud. ³⁷	Abscess.	?	Ninth day.	Intraperitoneal.	Laparotomy, eleventh day.	Empyema.	Cure.
64	Spillman. ³⁸	Gangrene, abscess.	Retrocecal.	Tenth day from beginning of appendicitis.	Extraperitoneal.	No operation.	.....	Death.

65	Weber (Sonnenburg). ³⁹	Abscess.	Subcecal.	Fifth day (?)	Extraperitoneal.	Lumbar incision.	Pleurisy.	Death.
66	Weber (Sonnenburg). ³⁹	Gangrene, abscess.	?	Eleventh day.	?	Aspiration of pus through eighth space.	Pleurisy.	Cure.
67	Weber (Sonnenburg). ³⁹	Abscess.	Subcecal.	Eighth day.	Intraperitoneal.	(?) Resection seventh and eighth ribs on fifteenth day.	Pleurisy.	Cure.
68	Weber (Sonnenburg). ³⁹	Abscess.	In front of colon.	Fourth day.	Intraperitoneal.	Resection eighth rib, eighth day.	Pleurisy.	Cure.
69	Weber (Sonnenburg). ³⁹	(?) No operation.	?	Sixth week.	Extraperitoneal.	Drainage of abscess from wound in iliac region.	.....	Cure.
70	Weber (Hermes). ³⁹	(?) No operation.	?	?	?	Resection seventh rib.	.....	Cure.
71	Umber. ⁴⁰	Abscess.	?	Third day.	?	Resection seventh and eighth ribs.	Secondary empyema.	Cure.
72	Elsberg.	Gangrene, abscess.	Subcecal.	?	Intraperitoneal.	Resection ninth and tenth ribs.	.....	Cure.
73	Elsberg.	(?) No operation.	?	?	Intraperitoneal.	Resection ninth and tenth ribs.	Secondary empyema.	Cure.

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ON THE DIFFERENTIATION BETWEEN INFLAM-
MATORY PROCESSES AND NEOPLASMS
OF THE BONES BY THE RÖNT-
GEN RAYS.

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MANY limbs have been sacrificed by unnecessary amputation, and many lives lost by deferred amputation on account of errors in differentiating the various inflammatory processes from the growths of the bones and joints. The Röntgen rays have opened entirely new fields in this sphere. If they cannot always give a positive answer, they often, by the method of exclusion, increase the chance of arriving at a correct diagnosis.

If in a case of an obscure swelling of the knee-joint, for instance, the Röntgen rays reveal no impairment of the integrity of the joint, otitis, tuberculosis, syphilis, or a bone injury can be excluded. It is certain, then, that only the soft tissues are involved. Thus we may, in conjunction with other clinical symptoms, be satisfied that we have to deal with a rheumatic swelling, for instance. But in many instances the Röntgen rays give a positive information.

Again, in *periostitis* as well as in *osteomyelitis* the skiagraphic signs are well marked. Abscesses cannot only be localized, but their extent is also so well outlined that the technical steps of the operation can be definitely traced in advance. The feeling of security the surgeon has while proceeding under the mentorship of the skiagraph gives a satisfaction unknown in former years, when often the whole femur, for instance, has had to be exposed simply in order to ascertain whether all foci were detected. If the Röntgen rays show but one focus, no other regions of the bone need to be attacked.

In such cases a preceding trauma often opens the avenue of infection. The pain, the œdema, the fever, and general debility may be sometimes so little marked that differentiation becomes difficult. The skiagraph not only clears this difficulty of diagnosing this disease, the true etiology of which is still so obscure, but also furnishes a trustworthy guide for the operative technique. Osteomyelitis is of a decidedly infectious character, generally due to the invasion of the staphylococcus into the blood circulation. Fortunately, this bacterium has a tendency of inducing the formation of circumscribed foci in the vascular tissues of the bone, viz., the medulla and sometimes the periosteum. The predilection of osteomyelitis is for the long bones of young individuals. It is self-evident, therefore, that the early recognition of osteomyelitic foci renders the prognosis of their evacuation extremely favorable.

In the case of a lady of twenty years the slow onset of the symptoms did not seem to indicate an acute inflammatory process. Pain being present only temporarily, the fear of a malignant growth was apparently not unjustifiable. The skiagraph at once did away with all anxiety, since it revealed the presence of periositic proliferations and a circumscribed osteomyelitic focus at the middle of the humerus. The focus was easily exposed by the chisel under the mentorship of the skiagram. That the skiagram had also spoken the truth by demonstrating the integrity of the remaining portions of the humerus was shown by the speedy recovery of the patient (Fig. 1).

The focus is distinguished by its light shade in the midst of the dark shade of the cortex. The regularity of the cortical line distinguished it from osteosarcoma, and the absence of distention from osseous cyst.

Necrosis and other later stages of inflammatory processes can be represented still more distinctly.

The size and shape of sequestra can be well made out. It can furthermore be ascertained how they are located in their bony coffin, and whether they still adhere or are exfoliated. Under the guidance of the Röntgen rays extraction is very easy.

Fig. 3 illustrates the case of a man of twenty-three years who had crushed his left little finger. Amputation was deferred until septic tenonitis and tenonothecitis had developed. The ex-



FIG. 1.—Periostitic proliferations and a circumscribed osteomyelitis of the humerus, six weeks after operation.



FIG. 2.—Showing large splinter of bone.



FIG. 3.—Exfoliation of sequestrum and regeneration of osseous tissues.

tensive tissue necrosis in the muscular interstices of the forearm necessitated free and deep incisions, which showed the radius as well as the ulna denuded of their periosteum. Amputation was therefore authoritatively advised; nevertheless, the chances of further conservative treatment were taken. My experience taught me to resort to amputation for sepsis only under the most extraordinary circumstances; and it seems to me that all cases which were saved by amputation would have recovered under the most vigorous conservative measures, especially excessive exposure of the foci and removal of suspicious tissue. Fortunately, the process became confined to the forearm, and recovery seemed to make rapid progress. Only a small fistula at the dorsum of the forearm did not close. The repeated introduction of a probe did not reveal the presence of rough bone, and I was inclined to suppress my suspicion of the presence of a sequestrum. My surprise was great when the Röntgen rays revealed the presence of so large a splinter as that which is shown by the skiagraph Fig. 2 and the photograph Fig. 3. The direction of the skin-incision, a slightly oblique one, was dictated by the position of the sequestrum as shown by the skiagraph. When the sequestrum was reached, it was found covered by thick fibrous tissue at the upper surface, while the inner and lower surfaces were exposed. This explains why the introduction of the probe gave no positive information, since it had touched only the fibrous cover, and did not come into contact with the rough lateral or posterior surface. Recovery was perfect eleven days after the operation.

The regeneration of osseous tissues can be well studied in such cases by the skiagram (see Fig. 3).

Foci of the same character are sometimes formed in *typhoid fever*. They have to be treated after the same principles.

In diagnosing inflammatory processes in the joints great difficulties are sometimes offered. As said before, in the case of *acute rheumatism* the integrity of the articular outlines is well marked. The same applies to *acute inflammatory processes* due to infection. In the latter event the distention of the joint by the serous or purulent effusion may be represented by the skiagraph.

In chronic rheumatic processes the articular bone-line appears somewhat irregular.

In *arthritis* the contours of the bone-epiphysis appear irregular, and show indentations on some portions, while others are veiled.

The arthritic deposits are recognizable as light shades of the deformed epiphyses, as they consist of translucent uric acid salts, while their periphery is distinguished by a dark sphere.

In cases of gonorrhoeic arthritis of the wrist the structures of the carpal bones appeared extremely light, and their contours irregular. They can, however, only be represented by using a soft tube, since the light of a hard one would penetrate the deposits to such an extent that they would leave no impression on the photographic plate. I take this opportunity to call attention to the necessity of employing soft tubes in general for the representation of osseous diseases of the hand, forearm, foot, and leg.

In *arthritis deformans* the ostitic proliferations are especially abundant, and are well shown by the rays.

Fig. 4 illustrates the case of a laborer of fifty years, who sustained an injury of his elbow eleven years ago. He reported that recovery took place after months, and that the elbow had remained stiff ever since. During the last few years inflammatory signs had manifested themselves which were regarded rheumatic. No other joints were involved. Since then he also had repeated attacks of pain in the elbow-joint.

When I examined the patient for the first time, I found the elbow very much thickened and fixed in a sharp angle. Pressure below the external condyle caused intense pain. Crepitus, so often found in old arthritic processes, could not be produced in this instance, as the joint permitted no motion at all. There were no indications of tuberculosis, syphilis, or gonorrhoea.

The skiagraph revealed the presence of malunion (side-ways displacement) of the coronoid process of the ulna, which probably had given the first impetus for the development of the arthritis deformans, which is especially well marked in the external condyle of the humerus. The left condyle shows synostosis with the olecranon. Removal of the projecting fragment by the chisel, separation of the adhesions, and the partial resection of the external condyle, the seat of predilection for the acute attacks, were advised as therapeutic means.



FIG. 4.—Malunion of the coronoid process of the ulna.

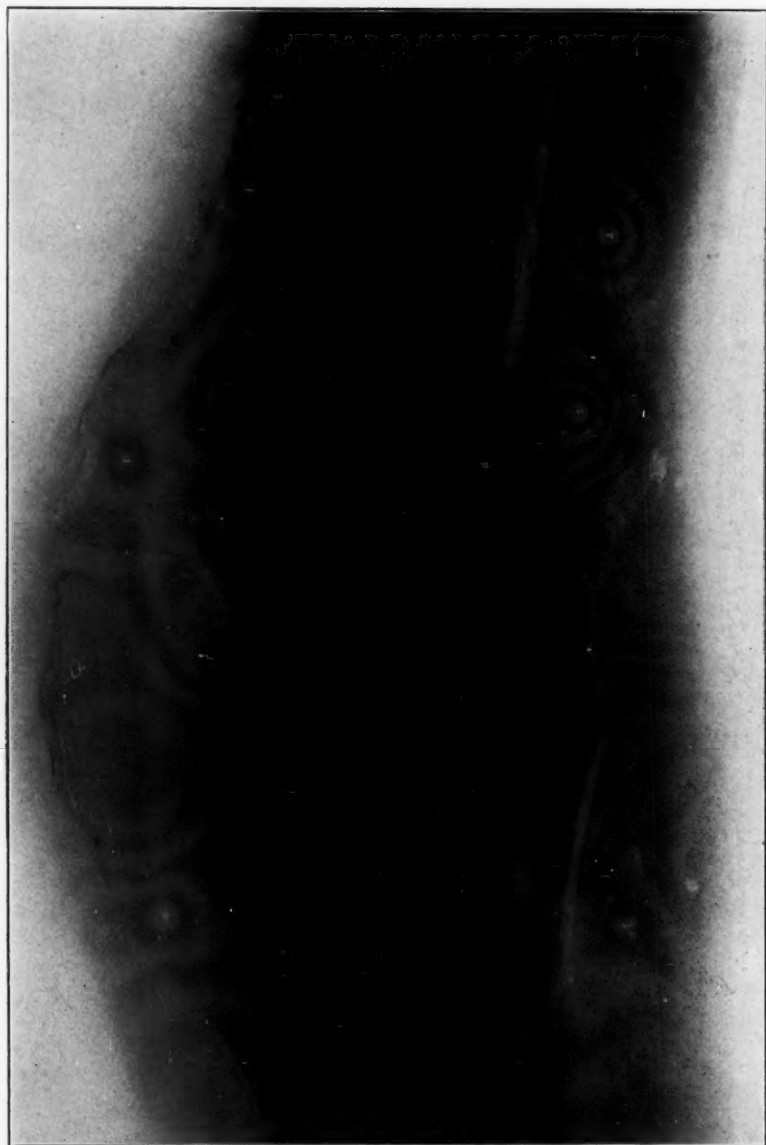


FIG. 5.—Tubercular knee-joint in a boy of thirteen years. The cartilage of the femoral epiphysis appears indented.

In *arthropathia tabica* the bone appears eroded, as in osteoperiostitis, but at the same time it is considerably distended.

In regard to the details of skiagraphic representation of *tenonitis* and *tenonothecitis prolifera calcarea* I may refer to my publication in the *New York Medical Journal*, April 27, 1901.

In *tuberculosis of the bones and joints* the Röntgen rays do not only give information as to the seat and extent of the tubercular areas, but also offer the only means sometimes of differentiation from other affections, the clinical signs of which resemble it. The walls of an intra-osseous focus appear thickened. Some portions are translucent and their contours irregular. The articular outlines of a tubercular joint have lost their regularity and appear diffuse, cloudy, and sometimes shaggy. (Fig. 5.) In later stages, when cheesy foci have formed, for instance, their areas appear translucent. The cortex is sometimes entirely destroyed and leaves the impression of being scooped out with a gouge. When there is calcareous degeneration, the foci appear dark-shaded.

In cases of extensive tubercular destruction the eroded and displaced cartilages can be studied. In tubercular coxitis the spontaneous upward dislocation of the femur and the separation of its head in the acetabulum can also be well recognized.

It need not be said that the early detection of a tubercular focus enables the surgeon to do a conservative operation, while at the late stage of extensive destruction such efforts are futile, as it is sadly illustrated by skiagraphic examination.

Cheesy foci of cervical and bronchial glands could also be reproduced by me distinctly when they contained calcareous deposits.

By realizing that so-called osteosarcoma is the most frequent of morbid osseous growths, and that of all tumors sarcoma offers the gravest prognosis, the importance of a thorough diagnosis need not be emphasized. The matrix of osteosarcoma, like that of all osseous growths, is either the periosteum or the medulla, in combination with the tissue originating from their proliferation.

Periosteal sarcoma is of a moderate hardness, and contains either round, spindle, or polymorphous cells. It attaches itself to the bone laterally, but may in its further development encircle it entirely. Periosteal sarcoma may become a real osteosarcoma at a later stage, when osseous trabecles are formed (see Fig. 6).

The skiagraph of periosteal sarcoma is characteristic, since it shows fine spiculated trabeculæ which radiate from the surface. Periosteal sarcoma spreads rapidly and is highly malignant. Whenever the diagnosis is made, amputation should be insisted upon. Fig. 7 illustrates periosteal sarcoma in a boy of fifteen years.

Fig. 8 (same case) shows the upper end of the humerus resected, while its skiagraph (Fig. 9) illustrates the degree of its translucence through the whole bone. Fig. 10 shows the dissected halves irradiated.

Sarcoma originating from the medulla is called myelogenous, and is of a less malignant character. It may be classified as soft, hard, alveolar, and multiple. The soft myelogenous variety shows the ordinary texture, the predominating feature being the presence of round cells. It has a decidedly more benign character than the periosteal type, and therefore justifies a conservative attempt, that is, extensive extirpation. Spontaneous fracture may be produced by the carious destruction of the spongy portion. At a later stage the osseous shell will yield, the sarcomatous tissue spreading all over.

This variety has a predilection for the long bones, especially their ends, and predominates at the lower epiphyses of the femur, tibia, humerus, and radius (Figs. 11 and 12). Skiagraphs of the soft myelogenous variety show the absence of osseous tissue, small fragments of it being sometimes left here and there.

Fig. 11, for instance, shows the faint outlines of bone-shell in the soft myelosarcoma of a woman of twenty-eight years, who had fallen on her hand in dorsal flexion. The swelling resulting from it produced the impression that a fracture of the carpal end of the radius was sustained. Three months after the injury,



FIG. 6.—Periosteal sarcoma, developing in real osteosarcoma and finally showing destruction of fibula and arrosion of tibia.



FIG. 7.—Periosteal sarcoma.



FIG. 8.—Upper end of humerus of case illustrated by Fig. 7.

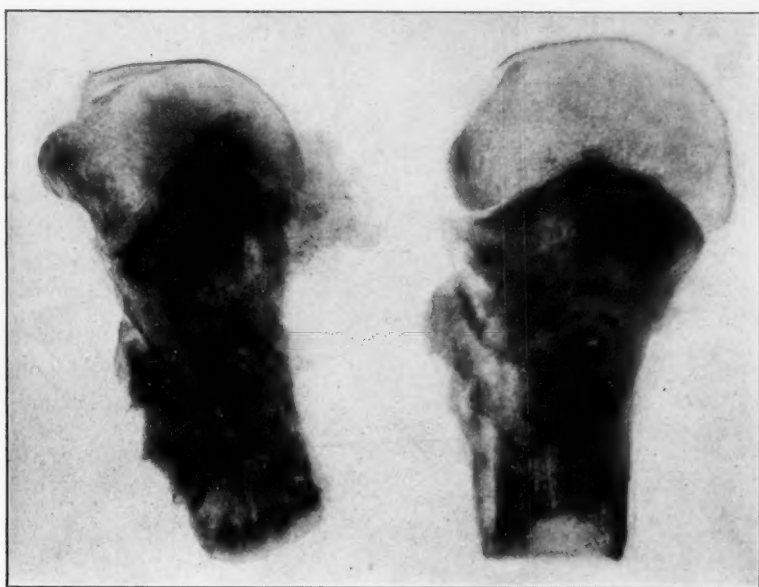


FIG. 10.—Skiagraph of the dissected halves of the upper end of the humerus (compare Figs. 7, 8, and 9).



FIG. 9.—Degree of translucency of sarcomatous humerus (Case illustrated by Figs. 7 and 8).

when I saw the patient for the first time, I noticed a small deformity, just as it is observed in badly united fracture of the carpal end of the radius; but the consistency of the epiphyseal end was soft. The skiagraph (Fig. 11) failed to show the evidence of bone-tissue, only one small remnant being left at the outer aspect of the radius. Resection was advised; but before the patient submitted to it, another month elapsed, during which time the neoplasm had grown to the extent illustrated by Fig. 12. The result was reported fair eight months after the operation.

The hard myelogenous variety, generally called endosteal or central sarcoma, also shows the ordinary sarcomatous structure. But its distinguishing feature is its fibrous texture and the presence of spindle cells. Some portions contain various tissues; the spindle-cell tissues often containing giant-cells. If smaller or larger bone-trabecles are produced it is called *osteosarcoma proper*; if there are calcareous deposits, *petrifying* sarcoma; and if the tissues become vascular, a *telangiectatic* sarcoma will be formed, so that it may be mistaken for an aneurism. In later stages, when there is a regressive metamorphosis, fatty or cystic degeneration may take place. Then neoplasms, which occur especially in the femur, tibia, and inferior maxilla, may attain an enormous size.

The skiagraph of osteosarcoma proper shows more osseous tissue than the former variety, but its outlines are very irregular. They usually commence near the epiphysis of a long bone.

Fig. 13 shows osteosarcoma proper in a woman of forty years. In Fig. 14 the destruction of the lower third of the radius and of a large portion of the carpus is seen. Resection was performed more than four years ago. The perfect result is illustrated by Fig. 15, which shows a slight and most uniform atrophy of the whole left hand. In Fig. 16, which was taken more than four years after the operation, the regeneration of the osseous tissue can be well studied.

The alveolar variety is characterized by its alveolar stroma, which contains nests of large cells. They have a predilection for the bones of the skull and the trunk.

The multiple variety (also called myeloma), characterized by the presence of numerous whitish foci, consists of small round cells. It has the same structure as the lymphoid sarcoma. It is nearly exclusively found in very old individuals, for whose skull and trunk it shows the same predilection as the former variety.

The skiagraph of the alveolar as well as the multiple type shows the foci as light, irregular shades. The structure of their type, especially their manner of destroying the pre-existing bone-tissues, the thin osseous walls and the trabecle-formation, is the stand-point for their skiagraphic study. Osteoporosis of the trabecles means decalcification of the bony portions affected, which explains their foggy shadows. Intra-osseous tension is responsible for the expansion of the compact osseous layer, which is thus made gradually weaker, and at last almost entirely disappears. Thus we see that it is the abnormal and indefinite outline or even the entire absence of the osseous cells, the cortex especially disappearing, which is more or less characteristic for the various types of osseous sarcoma in contradistinction to other bone diseases.

As to differentiation, it may be said that in aneurism the bone would show intact. At a meeting of the surgical section of the New York Academy of Medicine, January 9, 1899, I had an opportunity to call attention to the usefulness of the Röntgen rays in a case of femoral aneurism which, on account of its extremely thick walls, showed no pulsation; so that it had originally been taken for osteosarcoma, an amputation then having been considered. (See "On the Difficulty of Differentiating between Femoral Aneurism and Osteosarcoma," *International Clinics*, Vol. iv, Ninth Series.) The femur appearing intact, it was evident that there was a disease of the soft tissues.

In chronic osteoperiostitis the walls appear irregular, too, but the irregularity is one-sided, and there is a globular or spindle-like shape (compare Fig. 3). In tuberculosis the shade would be cloudy or shaggy (compare Fig. 5).

In osteomyelitis the cortex shows nearly normal outlines (compare Fig. 1).



FIG. 11.—Faint outlines of bone-shell in soft myelosarcoma.



FIG. 12.—Growth of the soft myeloid sarcoma, illustrated by Fig. 11, within one month).



FIG. 13.—Osteosarcoma of the wrist.



FIG. 14.—Destruction of the lower third of the radius and a large portion of the carpus.

The skiagraphic expression of syphilis is characteristic also. In the congenital form large ossified areas are recognized in the epiphyses, which would appear translucent in their normal cartilaginous condition (compare Fig. 18). On the other hand, light areas are noted in the diaphysis as an expression of insufficient calcareous deposition. The synostosis between the cartilaginous epiphyses and the diaphyseal end appears as a very marked line indicating the abundance of calcareous salts deposited there. Gummata show regular light-shaded foci. Their disappearance after the administration of iodide of potassium confirms the diagnosis.

Osseous cyst, showing the same clinical signs as osteosarcoma, may easily be confounded with it. But in osseous cyst, while there is the same bulging as in osteosarcoma, the line of the cortex, on account of its thinness, appears narrow, but well marked and regular. The fluid centre of osseous cyst renders the skiagraph translucent, the light shade showing the same regularity. The adjacent epiphyses are also normal in osseous cyst. The treatment of their various affections being difficult, the importance of a correct diagnosis is evident.

Osteomyelitis, necrosis, tuberculosis, syphilis, and osseous cyst demand conservative measures, while sarcoma calls for the most radical treatment.

The grave prognosis of sarcoma arms the surgeon against any feeling of sentimentality. Under such fatal circumstances he may not shrink from advising one of the most mutilating operations, because he knows that otherwise not only a limb, but also life will surely be lost.

On the other hand, how painful must it be for a surgeon to find that because of his error of diagnosis such radical steps have been taken unnecessarily; that, in other words, an extremity may have been amputated where only an osseous cyst existed, which could have been cured by simple incision!

It is, indeed, not very difficult to confound the two diseases,—osseous cyst resembling osteosarcoma in its slow and painless onset, often preceded by an injury; in the gradual bulging of the area involved; and in their preference for

youthful age and the long bones. These being characteristic features of osteosarcoma as well as of osseous cyst, it is evident that the differential diagnosis cannot be made by considering the history, nor by inspection, nor by palpation.

The fact that the interior of osseous cyst is filled with opaque blood-serum and that its walls are lined with a smooth coat, while in osteosarcoma solid masses are formed, indicates that an exploratory incision combined with microscopical examination would clear the question of diagnosis.

But the Röntgen rays give us more valuable information than the exploratory incision itself, and for the patient a photographic exposure is certainly more agreeable than an exploratory operation. Should an operation be decided upon, the microscopic examination can then just as well be made.

The correctness of the skiagraphic diagnosis was proven in two of my cases (shown to the surgical section of the New York Academy of Medicine, March 11, 1901), in both instances amputation having been advised because the diagnosis of osteosarcoma had erroneously been made. Fig. 17 shows the presence of osseous cyst at the upper end of the right tibia (compare normal left tibia).

At the early stage, osseous cysts, be they at the tibia or at the femur, are easily overlooked, the symptoms being insignificant. Sometimes there is very slight pain, which comes and goes. The joints are freely movable,—and neither inspection nor palpation reveals any abnormality. After months the circumference of the extremity may appear very slightly enlarged, but it may not be before a fall on the thin shell of the cortex produces a fracture that the symptoms are fully appreciated. (See "Osseous Cyst of Tibia," *American Journal of the Medical Sciences*, June, 1901.)

Other osseous diseases, like osteoma, osteomalacia, chondroma, also offer some skiagraphic peculiarities in proportion to their various textures.

It is of course necessary to know the skiagraphic features of the normal bone well, the main characteristics of which are the regularity of its shadows. The spongy portion, on



FIG. 15.—Uniform atrophy of the hand, four years after resection of the wrist (Case illustrated by Figs. 13, 14, and 16).

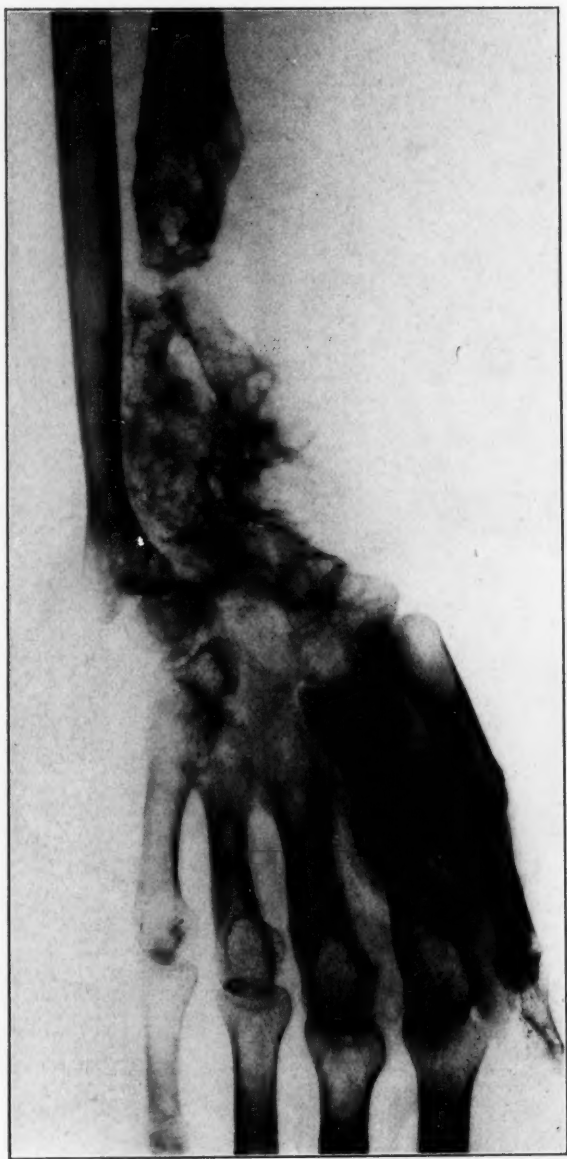


FIG. 16.—Regeneration of the osseous tissue four years after operation.



FIG. 17.—Osseous cyst of right tibia.



FIG. 18.—Hyperostosis of lower end of femur and upper ends of tibia and fibula, combined with premature synostosis and irregularity of cartilage-formation (luetic?).

account of its large amount of calcareous deposits, produces a darker shadow than the medulla.

Osteoma of course shows the shape of the osseous deformity; but there is the normal architectonic structure described, while *osteomalacia*, on account of the dissolution of the calcareous salts, is distinguished by the absence of an osseous shade. In contradistinction to osteosarcoma the whole bone appears translucent. In a case of old pyothorax I was unable to obtain a skiagraphic representation of the ribs, which I was inclined to attribute to a fault of my technic until repeated resection showed the presence of costal osteomalacia.

The presence of multiple exostoses leads to a suspicion of hereditary syphilis, when all other symptoms are wanting. In the case of a boy of five years, whose history was negative, the skiagraphic evidence of hyperostosis of clavicle, scapula, ribs, humerus, femur, tibia, and fibula were the only signs present at the time. The skiagraphic diagnosis was verified by the success of the antiluetic therapy. (Fig. 18.)

In *chondroma* there is a regular light-shaded area according to its cartilaginous character.

In *acromegaly* the phalanges of the head are broader than normal, and show no osteophytes; while their epiphyseal ends are thickened. The long bones appear straighter and broader than normal. Some of the carpal as well as of the tarsal bones are distinguished by the presence of exostoses.

Similar osseous and articular changes are found in *ostéo-arthropathic hypertrophiante pneumique*.

In *myxædema* the epiphyseal lines of the long bones are hypertrophied and show rich osseous proliferations, which, however, contain but few calcareous salts.

The changes in *rhachitis*, on account of the absence of calcareous deposits, are characteristic. They resemble those of osteomalacia, from which rhachitis is distinguished by the irregular arrangement of interspersed osseous structures as well as by the deformed shape of the bones. In cretinism similar conditions are found, the epiphyses being nearly invisible, while only the diaphyses show distinctly.

In Raynaud's disease the nutrition of the bones is much more disturbed than is assumed. The Röntgen rays clear up at least one feature of this sphinx-like vasomotor lesion.

In the case of a woman of forty years, who had been well until fourteen years ago, a slight pain in the index-finger of the left hand was felt. At the same time the patient noticed a marked pallor of the whole finger. Four months after the sudden onset of the pain, repeated congestion was observed in the region of the second and third phalanx of the same finger, which continued until about six months after the onset of the first symptoms. The tip of the fingers became dry and black; then an amputation had to be performed. The patient regained and kept her health, until six months ago the same pain and pallor extended symmetrically over both hands. When she was seen for the first time, a great pallor of the third, fourth, and fifth fingers of the left hand and of the little finger of the right hand was noticed. The second, third, and fourth right hand fingers were moderately anæmic. Sometimes the color changed into a cyanosed appearance. Both hands were very cold, just like in true gangrene. No other parts of the body were affected. There was no fever. The examination of the urine was negative. The patient did not seem to be hysterical, but apparently suffered intense pain sometimes.

The skiagraph showed atrophy of the upper end of the third phalanges (second phalanx of the thumbs) and osseous proliferation at the upper end of all second phalanges (first of thumbs). The third phalanges appeared triangular and resembled claws.

I found the same skiagraphic features in a man of thirty-one and in a woman of forty-nine years. (See also my publication on Raynaud's disease in the *American Journal of the Medical Sciences*, November, 1901.

The skiagraphic characteristics described are not expected to serve as substitutes for our well tested clinical methods of diagnosis, but should be regarded as valuable adjuncts in general, and sometimes as determining factors in doubtful cases.

ON THE PATHOLOGY, SYMPTOMATOLOGY, AND
DIAGNOSIS OF TUBERCULOSIS OF
THE PERITONEUM.¹

BY DANIEL N. EISENDRATH, M.D.,

OF CHICAGO.

Frequency.—Borschke found in 4250 autopsies, 1393 cases of tuberculosis, and of these, 226, or 16 per cent., showed evidences of an invasion of the peritoneum. These statistics, *i.e.*, 16 per cent., represent the average frequency with which tubercular peritonitis occurs in tubercular subjects in general at autopsy.

Etiology.—The majority of cases of tuberculosis of the peritoneum are secondary to a localization of the tubercle bacillus elsewhere (most frequently in the lungs and pleura). In the 226 cases referred to above, Borschke failed to find a primary focus in only two cases. The organisms may be carried to the peritoneum by a number of different ways:

(1) Through the blood, as a manifestation of a general miliary tuberculosis.

(2) By the lymph channels. This is most frequent after an intestinal tuberculosis, less often after a tuberculosis of the mesenteric glands.

(3) By continuity. In reality, this is also by the lymphatics, and may occur in one of two ways: (*a*) In the female, a frequent source is a tuberculosis of the tubes and ovaries. The bacilli, as has been shown in the case of the gonococcus, can either enter the abdominal cavity from foci situated near the fimbriated end of the tube or wander through the walls of the tube along the lymph channels and spaces of the same. (*b*) In the male the bacilli may get into the peritoneal cavity

¹ Read before the Chicago Surgical Society, May 3, 1901.

as a result of a tuberculosis of the genitals, in a similar way to that in which the gonococcus produces a gonorrhœal peritonitis secondary to an epididymitis along the lymph vessels of the spermatic plexus through the ampullar end of the vas deferens.

(4) Through the diaphragm secondary to a tubercular pleuritis or pericarditis, either by continuity, through ulceration, or along the lymph spaces of the diaphragm. The involvement of the pleura preceding that of the peritoneum is quite frequent. Osler found it three times in seventeen cases; Hane, nine times in twenty cases, and Bristowe, twenty-five times in forty-five cases.

Sex.—It was formerly thought that the disease was more prevalent in the male sex, this opinion being based upon autopsies; but since laparotomy has become such a frequent mode of treatment in this disease, all authors agree that the greater number of cases of tuberculosis of the peritoneum occur in the female.

Age.—The disease is rare below the age of three or beyond that of fifty. Kelly found the average age in twenty-nine women to be twenty-seven and a half years. In children, Holt, in fifty-six cases, found seven under three years, twenty-six from three to eight years, and twenty-three from six to eighteen years. In 357 cases collected by Osler, over two-thirds occurred between the ages of two and forty; and these two latter ages seem to represent the period in which it is most apt to occur.

Influence of Pregnancy.—Kelly calls attention to the fact that pregnancy is often followed by a tuberculosis of the peritoneum.

Pathology.—The disease shows itself chiefly in four forms:

First, hæmatogenous or disseminated miliary form. This generally occurs as a part of a general miliary tuberculosis, characterized by small grayish nodules scattered universally over the peritoneum and omentum, each surrounded by a hyperæmic zone.

Secondly, a local lymphogenous form most frequently secondary to an intestinal tuberculosis, less frequently to that of the mesenteric glands, retroperitoneal glands, or vertebræ. This is characterized by grayish or yellowish tubercles which follow the course of the lymph vessels closely and are often arranged in rows on the intestine. The tissue around the same is hyperæmic, at times there are a few hæmorrhages, often they are covered by granulation tissue or fibrin. This is the form which is so frequently found on the peritoneum of the cæcum accompanying tubercular ileocæcal disease.

The third form is exudative in character. We find in the peritoneal cavity a more or less serous, sero-fibrinous, or, if there is mixed infection present, even purulent exudate. In some cases, especially in alcoholics, the exudate may be hæmorrhagic. There is often a very thick eruption of grayish tubercles, the remainder of the peritoneum being more or less covered by a fibrinous exudate. This form is not infrequently accompanied by a cirrhosis of the liver; the relation between the two never has been rendered clear. This exudative form is the one which we recognize clinically by the presence of a free or sacculated ascites.

Fourth, the adhesive form, sometimes spoken of as the fibrous form. This is the slowest in development; it is the most frequent in children, and there is usually no ascites present. It is characterized by the formation of fibrinous membranes enclosing tubercles with extensive adhesion of the intestinal coils to each other, to the solid viscera, and to the parietal peritoneum. Where the peritoneum is visible, it is the seat of a very vascular, young, connective-tissue formation, with grayish or yellowish tubercles and large cheesy nodules and plaques arising from the caseation of the granulation tissue. The omentum is rolled up, at times transformed into a transversely running coil just above the umbilicus; the intestines are in a contracted condition, their walls are thickened, and between adjacent coils there may be a sacculated accumulation of fluid simulating a cyst. In children, in this form, the deposits may infiltrate the abdominal wall and cause a cellulitis of the

same, resulting in abscesses which open externally, usually around the umbilicus.

There is a fifth form which occurs in children (Holt), in which the enlargement of the mesenteric glands is the principal symptom. In the more advanced stages of the same, the only symptoms are those caused by pressure upon the great vessels, or thrombosis of the vena cava.

Symptoms.—Clinically, tuberculosis of the peritoneum does not present a group of symptoms which are characteristic for all cases. In the acute miliary form, the general completely overshadow the local symptoms. In the circumscribed local form there are also no special symptoms. We may, for the sake of brevity, divide the remaining cases into those (*a*) in which we have either a free or sacculated fluid; (*b*) into those belonging to the dry variety in all of its stages, in which the symptoms are in a great measure due to the adhesions of the intestines.

The disease may run an acute, subacute, or chronic course. Of the first named, cases have been reported in which the symptoms were those of strangulated hernia or acute appendicitis. There are again cases which seem to run a subacute course, resembling completely a typhoid fever. I saw such a case in consultation about two years ago, in which the temperature curve greatly resembled that of a typhoid, and it was only the obstinacy of the tympanites which attracted the attention of the attending physician. The third manner in which the disease can appear is in the chronic form. This latter is perhaps the most frequent form, although the others must not be lost sight of. In women, Kelly states that pain is the most common symptom, referred to the back and lower abdomen. He regards pain on urination as the most characteristic symptom in women; out of twenty cases, only three were free from it. In the majority of cases of tubercular peritonitis pain is usually only moderate; it may be elicited only on pressure or may be absent. There is no vomiting unless the case is a very acute one. Neither is there diarrhoea unless there is accompanying disease of the intestines. There is not infrequently

dilatation of the superficial abdominal veins, especially in children. There is absolutely nothing characteristic in regard to the temperature. Most frequently there is a slight persistent elevation of temperature to 99° and 100° F.; in the acute cases it may reach 102° to 104° F., and in the very chronic there may be subnormal temperature for months. Ascites, when present, may either be free or encapsulated. An exudate which at first may have been movable may gradually become less so as the disease progresses. According to Thomeyer, some stress is to be laid upon the fact that the intestine retracts towards the root of the mesentery.

Of considerable clinical importance as a symptom of tubercular peritonitis are the tumor-like thickenings of the omentum and the nodulated masses felt between the intestines. The former is felt as a transverse firm mass just above the umbilicus; the latter as movable tumors the size of a fist or larger, felt in various parts of the abdomen in those cases in which there is not much exudation, and, if the hand is placed upon the abdomen, friction sounds are not infrequently felt. In some cases of the dry variety the only symptoms may be those due to the stenosis of the intestines, *i.e.*, colicky pains and tympanites. Marasmus, gradual emaciation, progressive anæmia, and sweating may be quite marked. The liver and spleen are usually enlarged. At times the sacculated ascites may gradually increase in size, seeming to start from the pelvis, and thus resemble closely the growth of an ovarian cyst. The presence of a tubercular pleurisy is of great value in making the diagnosis of tuberculosis of the peritoneum.

Diagnosis.—The diagnosis in children is based upon the abdominal symptoms, such as distention, pain, and disturbed bowel action, the presence of fluid, and loss of weight. There is almost always a febrile rise of temperature of an irregular type. If the ascites is sacculated instead of diffuse, the diagnosis of tuberculosis of the peritoneum is even more likely. Cirrhosis of the liver is rare before the age of nine years, and if it is present, we usually have the history of syphilis and more or less jaundice. If there is no ascites present, we must make the

diagnosis on the presence of the irregular tumors. A chronic abscess in children, opening at the umbilicus, is always suspicious. The family history aids somewhat, but cannot always be relied upon. In adults, when there is no exudate present, diagnosis can often be easily made from the presence of the omental tumor and of the irregular nodular tumors. The latter are usually multiple, and must at times be differentiated from a multiple carcinoma. The transverse omental tumor must be differentiated from a gastric carcinoma. Kelly says that tuberculosis must be borne in mind in all cases of pelvic inflammatory disease, with masses posterior and lateral to the uterus, in which there is marked tenderness on pressure in the vagina or over the abdomen. He gives the following as the important differential points to distinguish an incapsulated tuberculosis of the peritoneum from an ovarian cyst or a fibrocystic tumor of the uterus: "(a) Rapid growth of the effusion. (b) Coincident pleurisy, a greater degree of gastro-intestinal disturbance than in ovarian cyst, and at the edges of the tumor, especially if the fluid has been removed by tapping, one feels irregular, hard masses. By bimanual examination through the rectum and abdomen, the cervix being drawn down, a fibrocystic tumor can be felt to be connected with the cervix; an ovarian cyst can be recognized by its pedicle. Occasionally tubercle bacilli or tubercles may be found in the discharge or in the curettings. When the ascites is free, we must distinguish it from the ascites due to cirrhosis of the liver, in which the history attained of a previous alcoholism and the examination of the character of fluid are the most valuable symptoms; although it must be borne in mind that the combination of tuberculosis of the peritoneum and cirrhosis of the liver is not infrequent. It is almost impossible to differentiate the simple non-tubercular from the tubercular peritonitis. When the family history is good, and there are no signs of tuberculosis elsewhere, no tenderness, and an excessive amount of fluid, the chances are that the case is one of simple peritonitis.

TREATMENT OF TUBERCULOSIS OF THE PERITONEUM.¹

By CHRISTIAN FENGER, M.D.,

OF CHICAGO.

It is impossible to elucidate this question satisfactorily without giving a brief *résumé* of the entire subject, and this is not as easy as would appear at first. Borchgrevink¹ states that our knowledge of peritoneal tuberculosis dates back to the year 1825, in the time of Louis, when only sporadic cases of the disease were known and when the diagnosis was made with great difficulty. This might be termed the first stage in the history of this disease.

The second stage was from 1825 to 1884, when tuberculosis of the peritoneum became better known and was more easily recognized. The relation between simple, non-tubercular, chronic peritonitis and tuberculosis proper excited considerable discussion. The simple peritonitis at that time terminated in recovery, while tuberculosis was said to be always fatal. Formerly, tuberculosis was considered as dangerous and fatal a disease as malignant tumor; but our views have undergone a radical change since that time.

The third stage of our knowledge regarding peritoneal tuberculosis began in 1884, when König proposed laparotomy for this condition. At that time the gravest apprehensions were entertained in regard to the disease, which was looked on as necessarily fatal, with but few exceptions according to Hilton Fagge, who stated that children frequently recovered.

The treatment of the disease, which is the part of the subject assigned to me, comes within the last twenty-five years.

¹ Read before the Chicago Surgical Society, May 3, 1901.

The surgical treatment of tubercular peritonitis cannot be discussed without taking into consideration the gradual change which has taken place in our ideas of tuberculosis in general, but more particularly of tuberculosis of the peritoneum.

In 1884, König² read a paper in which he reported four cases of tuberculosis of the peritoneum, one or two of which had been diagnosed as ovarian tumors. In others there was a localized peritonitic exudate which he advocated should be removed in the same way that an abscess is evacuated. König, who has done more towards increasing our knowledge of tuberculosis than any living man, and who would, naturally, be very cautious about drawing general conclusions from a few cases, said at the end of his short paper: "May this short paper have the effect that we soon will know more about this disease, as the experience from these cases is so little in harmony with our old views on the subject of peritoneal tuberculosis."

König's experience in these four cases was very favorable, inasmuch as three patients recovered and only one died. From this time on surgeons began to operate for peritoneal tuberculosis to such an extent that in 1889 König published a second paper,³ in which he was able to collect from the literature and from his own cases 131 operations for this condition. Of this number 120 were women and eleven men. He also reported the autopsy statistics of 107 cases, eighty-nine of which were men and eighteen women, showing an enormous difference as regards sex. This can be best explained by the fact that peritoneal tuberculosis is often found in the course of gynecological operations for other conditions, and that it exists as a relatively common and not fatal complication.

The result of operation in these 131 cases was good, as 107 of the patients were in satisfactory condition when they left the hospital. Of these 107, seventy-four were cured and thirty-three improved. König, however, asks the question, "How long does this improvement last?"

König was the first to call a halt in the wholesale operating for tuberculosis of the joints in the early stages, with a view to saving patients from general tuberculosis. He said that

patients should be traced for several years after operation for tuberculosis, and ascertained that after two years or more the recoveries which had been recorded as from 60 to 70 per cent. were reduced to 25 per cent. so far as radical cure was concerned.

From a study of the 131 cases collected from the literature, he concluded that the most common procedure was a simple incision through the abdominal wall. In some of the cases the wound was closed as soon as tuberculosis was observed, while in others the treatment consisted very largely of evacuation of the fluid.

In a minority of cases solid tuberculous products, thickened omentum or masses of exudate with conglomerated tubercles, were removed.

König, however, still concludes that "we stand before an enigma. May we hope that diligent use of laparotomy and careful scientific observation will clear up this enigma."

Teleky⁴ has summed up the whole question as to the value of the internal or non-operative treatment of tubercular peritonitis up to a year ago, and from his excellent paper the following *résumé* is taken. The common local remedies employed were green soap and mercurial ointment. For the relief of intestinal troubles, pain, etc., enemata and opium were given, and warm-water applications, rest in bed, alternated with fresh-air treatment hyperalimentation, etc., syrup of iodide, cod-liver oil, creosote, arsenic, painting the abdomen with tincture of iodine, and covering the abdomen with elastic collodion were recommended. Massage of the abdomen was advised by Thompson and Bouilly, and general roborative and dietetic treatment was recommended by all.

After 1884, an important change took place in our views with regard to peritoneal tuberculosis, when the introduction of laparotomy as a therapeutic measure materially changed the prognosis of the disease. As regards prognosis, Nothnagel states that spontaneous cure may take place. Chaffee and Hilton Fagge say that spontaneous cures are common in children, and Nassauer avers that this is the case in adults also. Marfan

thinks that there is a tendency to healing in many cases. He-gar saw one case in which, on the occasion of a later coeliotomy, a pre-existing peritoneal tuberculosis had entirely disappeared.

Up to 1884 all the cases of tuberculosis of the peritoneum in which recovery had occurred were regarded as mistakes in diagnosis; that is, they were considered to be cases of non-tuberculous peritonitis. After the treatment by laparotomy had been inaugurated, almost all the authors during the next fourteen years—up to 1889—reported recoveries in from 70 to 85 per cent. of the cases. The time of observation, however, was considered too short in all those series collected from the literature, because the operator made reports only a month or two after operation.

Von Winckel does not consider that a patient has recovered from the disease unless he has survived five years. Cellier reported 71 per cent. of recoveries in 287 cases shortly after operation, but after the patients had been observed for two years or more the percentage dwindled down to 25.

As regards anatomical recoveries, there is a limited number of cases on record with absolute disappearance of the tuberculosis that was found in the peritoneum at the time of operation.

The question arose as to the influence of operation on tuberculosis of the peritoneum, and this gave rise to a good deal of experimentation, of which the work of Gatti deserves especial mention. In the early stages, before the tubercles are fully developed, laparotomy has no effect. If caseation is present, laparotomy may check the tuberculous process, or cause encapsulation of the conglomerated tubercles, but the cheesy material is not resorbed.

All other forms of tuberculosis are retarded in development or brought to histological healing by laparotomy.

Grazer says that we are not only justified, but that it is our duty to try laparotomy in all cases of peritoneal tuberculosis, and Nothnagel deems it our duty to operate in most cases.

From a clinical stand-point, most authors distinguished three forms of tuberculosis:

- (a) The ulcerative or suppurative form.
- (b) The serous exudative form.
- (c) The adhesive form.

In the suppurative form cheesy matter predominates in the spaces between the intestines, and there are small cavities filled with liquefied cheesy matter or tuberculous pus,—a condition corresponding to that found in tuberculous abscess in other parts of the body. König in tuberculosis of the joints calls this condition tubercular pyarthrosis. Why is the tubercular process in this cheesy form sometimes called ulcerative? Because there is greater destructive activity in the tubercular process when pus is present than when there is only clear fluid. The ulcers perforate from the peritoneal side into the intestine, and we have spontaneous fæcal tubercular abscess followed by fæcal fistula. The mixed infection, from communication with the interior of the bowel, makes the prognosis more grave. True, opposed to all other writers, believes that tuberculous abscess in the peritoneal cavity is the only indication for laparotomy, and that puncture is sufficient in the serous cases. Angyrany considers that the ulcerous forms demand laparotomy only when they are localized. Naumann says that laparotomy is the only hope in the ulcerous form. Jaffe advises against operation in the ulcerative form with multiple abscesses, because in breaking down adhesions to reach the cavity we must and will tear the friable bowel wall.

In the form with serous exudate, Teleky states that the good effects of laparotomy cannot be disputed when the cases are considered as a whole. Jaffe, the most sceptical of the later writers, believes that the effect is only symptomatic, and leads eventually to the adhesive form of the disease, and this, in his opinion, is a step towards recovery. Monti, although sceptical, says that at times the effect of laparotomy is satisfactory. Many other writers speak more favorably of laparotomy in the cases of serous tuberculosis of the peritoneum. The percentage of recoveries, from the experience of all authors, averages 75 for both children and adults in this form of the disease. The prognosis is better after laparotomy in the

serous form without adhesions, and less favorable in the cases with encapsulated exudate.

In the adhesive form of tuberculosis the opinions of authors as to the effect of laparotomy are diametrically opposite. Merkel says that operation is the only remedial measure to adopt. Condamin and Margarucci consider that the operation is strongly indicated. Thomas reports 66 per cent. of recoveries in these cases. In one of Condamin's cases, which terminated in cure, the peritoneal cavity was obliterated by extensive adhesions. Jordan advises, in such cases of complete obliteration of the peritoneal cavity, to make two or three incisions below or, better, above the umbilicus through the abdominal wall. In my opinion, this is the height of folly, because there is no peritoneal cavity to enter. Borci, Schmitz, and Israel are in favor of laparotomy. Thompson, Angyrany, and Naumann are less enthusiastic, and hold that laparotomy is indicated only when pain and symptoms of occlusion become manifest. It is doubtful whether we should operate for pain alone; but in cases of occlusion operation must be done, and this should not be confounded with, or considered in connection with, operative measures for peritoneal tuberculosis.

Monti says that this form is not suitable for laparotomy; Jaffe considers the operation useless and even dangerous from the risk of injury to the bowel and of faecal fistula.

As to the effects of operation in the three forms of the disease, Teleky, from the literature, comes to the conclusion that in the ulcerative form an unfavorable operative prognosis must be given; that is, that operation is the last resort. In the miliary, serous, exudative form, operation is followed by the best results, and is probably always indicated.

In the adhesive form it is difficult to give definite indications for operation; but it is probable that operation is advisable when, after prolonged conservative treatment and observation, there is no tendency towards recovery. In such cases resort should be made to laparotomy because other therapeutic measures have proved ineffective. This conclusion seems to me to be on a par with the advice to cut irrespective of

consequences in other incurable diseases, such as cancer, cirrhosis of the liver, Hodgkin's disease, exophthalmic goitre, etc. Different opinions prevail as to the period of the disease which should be selected for operation. Drackel, Schmitz, and Nothnagel say that we should operate before extensive caseation has taken place. Merkel would operate earlier. Gatti and Hildebrandt, from experiments on animals, would not operate early because too early operation has no influence on the tuberculosis.

The effect of laparotomy as a means of cure in many instances is only apparent, and in spite of seeming recovery peritoneal tuberculosis gradually progresses. Some patients enjoy a period of comparative health for one or two years; that is, operation obviates mental and bodily misery for that length of time. In many such cases the first laparotomy was not effective; some of the patients, however, were cured by the second operation. One patient underwent four operations before an absolute cure was effected.

As a parallel, Teleky mentions laparotomy for sarcoma or carcinoma of the peritoneum in which operation has apparently exerted a beneficial effect.

Technique of the Operation.—Teleky, from the literature, gives the following technique of operation:

Vaginal laparotomy has been done only once by Condamin, but all others, as Von Winckel, Martin, Hegar, are opposed to this procedure as the opening is too small. Trans-abdominal laparotomy is the prevalent operation. The abdomen is first opened and the fluid evacuated (Merkel). The cavity is then dried by careful removal of all fluid with sterile sponges. Weak antiseptic solutions are used by Von Winckel and stronger antiseptic solutions by Hayem, Galvani, Westphal, Israel, Gustinelli, and others, for irrigation of the cavity. Iodoform powder is rubbed in by Diddens, Rendu, Noré, Joserand, and Schmitz. Jaffe considers that rubbing with iodoform causes a beneficial injury of peritoneum resulting in adhesions which further the cure.

The disposal of the primary focus if located in the abdomen has been considered in widely different ways by various

authors. Quervain advises that it be removed; the removal of the appendages has also been advocated; Scheuer advises that a bowel with tuberculous ulcers be resected, while Schmitz is opposed to this course; Von Winckel advises that the tubes be removed if this can be easily done, but other writers advise that the primary focus be left, as it is helped by the laparotomy. Others, Valenti for instance, consider that laparotomy cures distant foci, as, for instance, pulmonary tuberculosis, and Merkel believes that the operation improves it. On the other hand, Monti and Jaffe aver that laparotomy is often followed by rekindling of a latent tuberculosis in distant organs.

As regards closure of the abdominal wound, Von Winckel considers drainage superfluous, and most authors close the wound without drainage; but Grazer inserts an iodoform gauze drain in the lower corner of the wound, and some operators pack the abdominal cavity with iodoform gauze.

Within the last year three excellent papers have appeared in which series of cases have been reported. One of these papers was by Herzfeld,⁵ with a report of cases from Körte's clinic; one by Frank,⁶ with cases from Czerny's clinic, and the third by Bottomley,⁷ who reported twenty-eight cases from the Boston City Hospital. There is a great similarity in these reports. From Czerny's clinic forty-one cases were reported, of which 26.8 per cent. recovered and remained well for three years, and 19.5 per cent. recovered for a shorter period than three years. Five patients recovered with complications, namely, relapse, hernia, and fistula; four were not cured; and fourteen died, but only three of these from the operation itself.

By reason of the resistance offered by the peritoneum to ordinary pus microbes, the operation has a remarkably low mortality of from 1 to 2 per cent. Faecal fistula appeared in six out of the nineteen cases of tuberculosis sicca. This demonstrates how easy it is to injure the intestine in the dry form of tuberculosis in an attempt to loosen the intestines to reach the semifluid exudate, and also how easily gauze drainage may aid the tuberculosis in perforating into the bowel with a resultant faecal fistula.

Czerny advises extirpation of the tuberculous adnexa before tubercular peritonitis sets in. It is hard to conceive how a diagnosis could be made before that time; it would be largely accidental or purely guesswork. Tuberculosis of the peritoneum disappears in cases where the appendages are left. It seems feasible, however, in a limited number of cases to remove the tuberculous appendix. When fæcal fistula is present, the attempt to close it is a thankless task, and it is much better to let it alone. In three out of four cases Czerny failed to close fæcal fistulæ by suture. He reports eight cases, three of which remained cured after three years, and two, two years later. Three patients died in from two months to a year after operation. Czerny considers the results as not bad; that they are about as good as those obtained without operation.

Herzfeld concludes "There is nothing left but to confess that we still stand before an enigma which for the time being cannot be cleared up."

In 1900 the best prognosis of operation for tuberculosis of the peritoneum was 40 to 50 per cent. of cures in the most favorable forms of the disease. In the ulcerative form, the prognosis was grave, and these patients almost always died. When stenosis of the bowel complicates peritoneal tuberculosis, operation should be done, but cure is rare.

Frank reports eight cases in which conservative treatment was employed. Three of these patients were well after three years and two were well two years later. Three died; one in a few days, one after two months, and one after a year. Frank considers these results not bad, but regrets that neither reports nor statistics from the internal-medicine clinics exist from which the fate of patients with tuberculosis of the peritoneum thus treated might be compared with the results in patients subjected to operation.

We must regard tuberculosis as a disease having a tendency towards spontaneous recovery. König and Hegar believe that this tendency to recover is aided by laparotomy; others are inclined to believe that it is due to the laparotomy itself. The conclusion has been reached that the recovery

from tuberculosis is due to a combination of effects, such as a change in the circulation, a change in abdominal pressure, the beneficial influence of laparotomy, etc.

There is very little difference between the results reported by Bottomley and those of the other two. Bottomley reports a series of twenty-eight cases of tuberculosis from the Boston City Hospital. He states that the disease is more commonly met with in women than in men, because, in all probability, laparotomy is performed more frequently on women. According to the reports of the Boston City Hospital, however, fourteen men and fourteen women were affected with the disease. In the eighteen cases in which drainage was used, fæcal fistula followed in five. Drainage was instituted in ten of the eleven fatal cases. There was no drainage in eleven of the twenty-eight cases, and in only one of these was there a fatal result.

The mortality from the operation is practically *nil*, and, consequently, these patients do not die because of the operation. It is rare for sepsis to occur in a tuberculous peritoneum, and it is also rare for tuberculosis to develop in the drainage tract. Only one case of the latter has been observed by Nas-sauer.

Bottomley says that laparotomy may be done under local anæsthesia in the case of patients weakened from tuberculosis of other organs and in those in which the disease has reached an advanced stage.

As regards the immediate result, he says that there is always more or less improvement in the general or local condition of patients, twenty out of twenty-eight of whom showed immediate improvement. Of these twenty, eleven improved both locally and generally, while the remaining nine improved as to their general, but very little as to their local condition. In four of the cases followed by no improvement after operation the patients all died. Entire absence of pain and distention of the abdomen is uncommon even in the most favorable cases when discharged from the hospital three weeks after operation. In most of the cases, operation was followed by reduction of the temperature, but this did not fall to normal,

as most patients had some fever when they left the hospital. Finally, he says, apparently desperate cases have been restored to perfect health.

Kümmel, Richelot, Welch, Nassauer, Jordan, and Wunderlich have demonstrated anatomical cures.

The conclusions to be drawn in this regard up to and including the year 1900 are as follows: A cure may be expected in from 30 to 40 per cent. of the cases that heretofore were considered fatal. In the fatal cases, the patients die in five or six months after operation; that is, about one-half of the patients die at the height of the peritonitis; the other half die within a year to two years. In the cases in which the patients do not recover from the operation, either locally or generally, no benefit is derived from the operative interference, and the prognosis is unfavorable.

After having ploughed through this chaos, out of which it is next to impossible to extricate a ray of light, because reasoning is at a stand-still despite the enormous labor of a multitude of able and indefatigable workers in all countries, one cannot but feel inclined to look for a new departure. It is refreshing at last to find an author (Borchgrevink) who, after the most careful and painstaking labor with all the weapons of modern scientific investigation at his disposal, has the courage to tear down this whole artificial house of cards and make *tabula rasa* of the entire question.

How easy it is to be deceived when one tries to draw conclusions from his own limited experience or from the few cases one meets with as a casual observer, I will give an example from my own practice.

About ten years ago I operated, for chronic intestinal obstruction, on a woman of about thirty. She was pale, but well nourished, and had a swelling in the region of the appendix and cæcum, and daily attacks of painful contractions of loops of bowel in the right iliac region which were visible on the abdomen during the attacks which were often followed by vomiting. A diagnosis of stenosis in the cæcal region was made, but operation revealed tuberculosis of the appendix and cæcum with considerable thicken-

ing and retraction of its wall whereby its lumen was made too narrow for free passage of fæces. Excision of the thickened wall of the cæcum and transverse union of a longitudinal defect were thought efficient to establish a sufficiently free passage from the ileum down into the colon. At the time of operation the peritoneum was normal. Relief for a time followed, although a small fistula, generally mucous but occasionally slightly fæcal, remained. After a year and a half the symptoms of obstruction gradually returned and the fistula became constantly fæcal. Thereupon I planned to extirpate the cæcum if practicable, or otherwise to relieve the obstruction. When the abdomen was opened, I found diffuse miliary tuberculosis over the whole of the free peritoneal cavity. The cæcum and lower portion of the ascending colon formed a solid mass three inches long and two inches in diameter, adherent to the iliac fossa and the lower end of the ileum so firmly that I deemed extirpation inadvisable when the tuberculosis of the peritoneal cavity was taken into consideration. Ileocolostomy was resorted to, uniting the nearest free loop of the lower ileum with the transverse colon. Both portions of bowel were thickly covered with gray miliary tubercles, but no fibrinous exudate, free fluid, nor caseous larger nodules were present, and the intestinal walls were not any more thickened than the presence of the tubercles would account for. An opening two and a half inches long in both portions of the bowel was sutured in the usual manner. The fæcal fistula leading to the cæcum was left open.

In spite of the miliary tuberculosis, recovery from the operation was undisturbed, and the effect of the ileocolostomy was complete relief of the obstructive symptoms, which permitted the patient, a poor woman with a large family, to resume her household duties. The cæcal fistula secreted a little mucus with rarely a trace of fæcal matter.

I have heard that the patient died about two years ago after she had had five or six years of relief from the obstruction.

This led me to draw the conclusion that miliary tuberculosis on the serous covering of the intestines—tuberculosis of the peritoneum—was no contra-indication to operation on the intestines; that an intestinal wall filled with miliary tubercles in the subserosa would permit of suturing and would unite almost as readily as a non-tuberculous wall.

If I had published this case, I should certainly have expressed the above conclusion as an opinion fortified by the case. How erroneous this conclusion would have been we can see from the accumulated experience and knowledge of tuberculosis of the peritoneum, where perforation of the bowel and faecal fistulae are seen in cases not operated on; in cases operated on by simple laparotomy, many of which had adhesions, and in the majority of cases of operation on the tuberculous bowel wall.

Czerny reports a death in ten hours after resection of nine centimetres of bowel. Rotgans and Helmerich report suture of a tear in the bowel ruptured by loosening of adhesions in which the sutures did not hold. Korteweg reports a case in which the sutures cut through.

In a patient of my own, a doctor's wife, with multiple tubercular stenosis of the ileum and eight or ten strictures over ulcers, I did not make a resection, but a simple enterostomy above the most proximal stricture; but the patient died from shock in less than twenty-four hours.

Borchgrevink, in his excellent paper, has now brought the subject back on a rational basis by most scientific and careful observation of two almost equal series of cases of peritoneal tuberculosis, one of which was treated by laparotomy and the other without operation.

He has observed twenty-two cases treated by laparotomy and eighteen cases treated without laparotomy. In addition to this, he has made a number of observations on so-called simple peritonitis which he almost always was able to demonstrate to be tubercular.

Of these twenty-two cases of laparotomy, eleven patients had fever and in the other eleven it was absent; of these latter ten lived and one died. Of the eleven with fever, eight died and three only were cured.

The forms of peritoneal tuberculosis without fever or with only slight fever usually run a favorable course and laparotomy is unnecessary.

In progressive tuberculosis, or the ulcerative form, most

of the patients die from the disease sooner or later, and therefore laparotomy has no influence on them. In the eleven cases reported with fever, laparotomy undoubtedly did harm in nine, and it is not proven that the operation was responsible for or aided in the improvement in the other two cases.

In general, Borchgrevink concludes, after careful observation of the patients operated on and of their condition before and after laparotomy, that if the operation did any good it was, to say the least, doubtful.

His conclusions from these cases are the following:

"That the laparotomy, in strong patients in whom fever is absent and their condition of good nutrition speaks for a spontaneous disappearance of the tuberculous process, is well tolerated.

"Laparotomy, however, in patients with fever, when the tuberculosis has a progressive character, must diminish what slight power of resistance such a patient has remaining. This power of resistance may thus yield, and death follow, or it may, by concurrence of fortunate circumstances, rebound, and the patient recover in spite of the operation.

"That form of peritoneal tuberculosis which exists without fever, or with only slight fever, runs in itself a favorable course. In such cases laparotomy is unnecessary. In progressive tuberculosis the operation is dangerous and should be abandoned."

Of the twenty-two cases which Borchgrevink reports eight were light, six moderately severe, and eight severe. Fourteen of the patients, or 63.6 per cent., recovered and eight patients, or 36.4 per cent., died.

In seventeen cases conservative treatment was employed. Of these, fourteen, or 82.3 per cent., recovered and were still well after two or three years, or were clinically cured and remained well for two or three years. Of the three patients who died, the death was due in one case to tubercular peritonitis, in a second to intestinal tuberculosis after six months, and in a third to measles after five months.

The question of the disappearance of fluid exudate after

puncture as compared with the result after laparotomy shows seven negative results out of fifteen laparotomies and fifteen negative results out of nineteen punctures. But in eleven of the latter the exudate was absorbed spontaneously later on.

The advantage of laparotomy over puncture, as regards its effect on the exudate, is probably more apparent than real. It seems likely that the termination of the progress of the tuberculous process is the main factor in the causation of improvement, and in one or the other of these conditions the method of evacuation of the exudate is immaterial.

The frightfully disappointing results of the energetic surgical treatment of peritoneal tuberculosis—curetting, excision of tuberculous tumors in the omentum, adhesions, and mesenteric glands—must teach us that nature cures tuberculosis of the peritoneum better than the surgeon.

Are there any cases of tuberculous peritonitis for which laparotomy is the only means of cure or in which laparotomy is the best method of treatment? Borchgrevink does not hesitate to state that even the "serous tuberculous peritonitis is a territory which surgery must hand back to the internal-medicine clinic with thanks for the splendid opportunity which a misunderstanding gave to the profession, by means of laparotomy, to study tuberculosis in one of the large cavities of the body."

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TUBERCULOSIS HERNIOSA AND APPENDICITIS TUBERCULOSA.¹

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I. *Tuberculosis Herniosa* (Bruns), *Hernientuberculose* (Pitha).—Pitha in 1845 first noted and reported a case of hernial tuberculosis. The patient, a woman with general strumous symptoms, had a right femoral hernia which became strangulated and required herniotomy. A diffuse thickening of the sac and a bloody serous effusion were found. The patient died, and an autopsy showed general tubercular peritonitis in which the hernial sac participated through a very small ring and neck.

These conditions were not so well known at that time, but the case is fairly typical of a class which has been reported occasionally ever since.

Lejars (1889) reviewed the cases of Cruveilhier, Hayem, Brissaud, Puesch, and Largeau, and added two cases. Von Brackel (*St. Petersburger medicinische Wochenschrift*, October, 1897) adds two new cases, beside which we have reports by Jonnesco (1891), 4 cases; Phocas (1891), 13 cases; Bruns (1892), 1 case; Southam (1892), 2 cases; Haegeler (1893), 1 case; Tscherning (1893), 1 case; Teuderich (1895), 3 cases; Roth (1896), 3 cases.

Ott has also reported a case of a tubercular ulcer and perforation in a strangulated hernia.

Von Brackel's two cases are reported very carefully.

(1) A man, aged thirty-eight years, had right inguinal hernia for which Bassini operation was being done. The tissues around the sac

¹ Read before the Chicago Surgical Society, May 3, 1901.

were found somewhat adherent. After pressing this back partly into the abdomen the sac wall was found nodular; 400-500 cubic centimetres of yellow, clear fluid with flocculent masses were drained from sac. The inner wall of the sac was injected and studded with nodules from the size of a pinhead to flaxseed. The omental and other contents were in the same condition. The omentum was removed with ligature and Paquelin cautery. So far as one could see into the abdomen, the rest of the contents looked normal, except one or two small spots on adjacent loops of bowel. Patient made a good recovery. Microscopic examination of the removed omentum showed many spots of conglomerate tubercle.

(2) Woman, aged twenty-eight years, with history of former pleurisy and indigestion, had a hard, tender tumor in right femoral canal which was elastic and gave no impulse. The connection with the abdominal cavity was not easy to make out. Operation showed a tense sac, from which was evacuated a clear, yellowish fluid containing white flakes. It also ran out of the free peritoneal cavity above. The inner wall had red miliary tubercles on its surface and numerous rice bodies. Recovery good, with some colic. No tubercle bacilli found in specimens removed, either fluid or sac wall. This case had a general tubercular history as evidenced by the pleurisy and intestinal catarrh.

I can add two cases of hernial tuberculosis which bear a very marked resemblance to the above; indeed, all those reported in the literature are strikingly similar.

CASE I.—Girl, twenty-three years old; had a left femoral hernia of two years' duration. This was somewhat globular, tense, and irreducible. The tumor was dull on percussion and the absolute diagnosis of rupture rather difficult. Operation showed a thick sac studded with fibrous nodules and filled with yellowish serum, but no other contents. The opening into the peritoneal cavity could only be made with a probe, and probably was not patulous. The whole sac was removed and the general peritoneum not inspected. Diagnosis, fibrous, tubercular peritonitis of sac only in the *statum precaseosum*. I regard this as a purely localized process, as there was no tubercular history before or after operation. The microscopic diagnosis was negative as to bacilli, but the nodules showed much round cell infiltration and giant cells.

CASE II.—Man, forty-seven years old. Large right scrotal hernia, partly irreducible. No gurgling when reduced in part. Operation showed a very thick sac wall studded with many nodules and a rolled-up mass of omentum grown to the sac in

places. The fluid was clear and white, and ran freely from the abdomen, although no distention existed. All loops of intestine and the greater omentum were covered with small tumors, those in the omentum being hard and fibrous and as large as hazel-nuts.

Diagnosis, *peritonitis exudativa tuberculosa*. The sac was quite difficult of removal. All of the contained omentum, which was a thickened, roll-shaped mass, was removed by ligature. This case showed diffuse involvement of peritoneum, and probably should have been treated by a general laparotomy. I had no consent to do this, and afterwards lost sight of the patient. He remained well for several weeks and had no perceptible ascites.

In neither of these cases did I recognize the true condition before operation; but in one of Von Brackel's cases the diagnosis was made before operation, which is certainly a creditable piece of scientific work. Isolated hernial tuberculosis is perhaps impossible to diagnose until it is found in operating. It is easier to attain this with general tubercular peritonitis present, but is also very easy to overlook it. The disease may be either primary or secondary; in the latter case it is the localization of a general tubercular peritonitis due to irritation, stasis, and lowered nutrition constituting a *locus minor resistentiæ*. Jonnesco believes tuberculosis has a predilection for the hernial site because of interference with the circulation, by slight trauma, perhaps unnoticed, by trusses, etc.

Lejars asserts "*la peritonite tuberculeuse herniare est une peritonite entièrement locale*," a statement which should be accepted with great restrictions.

Diagnosis.—While these rare cases will usually be diagnosed during operation, the following points are well agreed upon as aiding in the pre-operative diagnosis.

- (1) No bowel in the sac, but some fluid.
- (2) Sac distends with upright position.
- (3) Sac refills quickly after emptying.
- (4) No gurgling felt or heard on taxis.
- (5) Spontaneous return on lying down.
- (6) Percussion note is dull.
- (7) Sac feels thick and irregular.

(8) Sac often tender and inflamed.

It may be stated that the condition is ordinarily no bar to operation. In fact, there may be every reason to operate early and radically in order to eliminate the disease if it be local.

The following conclusions seem justified by our limited experience:

(1) All cases, general or local, should be operated upon early.

(2) All the sac and all the diseased omentum should be removed high up.

(3) The repair seems good in these cases, and any radical cure method (except those of Macewen or Kocher, in which the sac is left) can be employed.

(4) If hernia tuberculosa is found during operation, it would often be better to make a general laparotomy at once. If this cannot be done, a relaparotomy should be performed later.

II. *Appendicitis Tuberculosa* (Sonnenburg); *Cæcumtuberculose* (Conrath); *Tubercular Ileocæcal Tumors*.

"C'est surtout aux bord de la valvule ileocæcale que les ulcérations atteignent leur plus développement."—SPILLMANN.

"Habituellement les lésions sont surtout confluentes dans la fin de l'iléon et dans le cæcum."—GIRARDE.

In considering the differential diagnosis between the various forms of tumors and inflammations of the ileocæcal region, Sonnenburg warns us of the tendency of appendicitis tuberculosa to simulate carcinoma and old appendicular abscess, especially when the disease has spread to the cæcum and surrounding parts.

I wish to offer four cases of tubercular peritonitis limited to these parts, in three of which the trouble was mistaken for acute appendicitis by my colleagues and myself. In the fourth case I was able to diagnose the true condition correctly before operation. The peculiar clinical feature of this trouble is that the disease should so often attack a certain limited section of the abdomen, leaving other parts normal. This apparent frequency may be in part fictitious, and only due to the more

anxious and frequent examination which is now being bestowed upon the appendix region alike by physicians and surgeons.

It will not be necessary to reprint the case of Sonnenburg nor those of later writers. Two of my cases antedated the publication of Sonnenburg's article. Conrath (1899) gives two admirable photographs of the specimens in a report of five cases. Paul Hermsdorf reports several cases of primary tuberculosis of the bowel and adnexa with stenosis of the ileocæcal valve. Max Zahn gives two cases, both children. Eisenhardt reports one case. Hacker reports several excisions for this disease. A. Multhe adds two cases, and Moizard notes the tendency of tubercular tumors of the cæcum to simulate appendicitis, and reports instances. Behrens reports a case with three tubercular ulcers near the ileocæcal valve. My own cases are the following:

CASE I.—Ileus and tumor at McBurney's point; operation; tuberculosis of cæcum, colostomy, recovery; second operation, ileocolostomy, death. Woman, aged forty-two years; referred by Dr. Billings, with history of old intestinal indigestion. Present trouble of a few days' duration. Paroxysms of pain, sometimes general, often in right lower abdomen. Some distention and vomiting. Tumor, size three by six inches, over cæcum. Operation showed tuberculous peritonitis of exudative dry form, with large nodules and wall of cæcum half an inch thick. The lumen of the gut was encroached upon near the hepatic flexure, and obstruction resulted. An artificial anus was made, and recovery followed, but patient continued to have diarrhœa and was weak. A month later I made a lateral anastomosis with the Senn plates between the ileum and transverse colon. The patient died in three days with general peritonitis, the repair being imperfect at the point of union. Autopsy showed some leakage. The tuberculosis was mainly limited to the cæcum and lower ileum. The mesenteric glands were somewhat enlarged, and there were a few round ulcers in the cæcum.

CASE II.—Acute obstruction with large tumor in right inguinal region. Operation; tubercular mass found and not removed; gradual exhaustion, and death. Child, female, aged six

years, brought to Michael Reese Hospital for operation for appendicitis. I did not suspect any other trouble until after opening the abdomen, when the tumor was found to be a tuberculous peritonitis agglomerating the colon, appendix, ileum, and omentum into an indistinguishable hard mass the size of two fists. I was quite unable to disentangle the various loops of small intestine, and, as the mass seemed too large for resection, I closed the abdomen with large iodoform gauze strips around the tumor. No especial improvement followed this. The bowels became slightly pervious and the vomiting ceased. The tumor did not change in size, and the patient died in about six weeks.

CASE III.—Tuberculosis of bowel and peritoneum in ileo-cæcal region simulating appendicitis. Operation; general adhesions from tubercular peritonitis, artificial anus, recovery from operations, gradual death from marasmus. Male, aged thirty-one years, referred to my service in Mercy Hospital for operation. History of chronic indigestion. Present illness two weeks' standing, with vomiting, pain in right side, and obstinate constipation. A tumor the size of a man's fist was felt deep in right side of abdomen above Poupart's ligament. This also proved to be a mass of tubercular nodules. I found it impossible to resect, and made an artificial anus. Later, I reopened the abdomen in the median line. All the viscera were so adherent as to resemble a solid mass, which did not look as if it were traversed by any pervious route. The peritoneum was studded with large and small nodules and quite red. I found great difficulty in raising two adjacent loops of intestine enough to make a lateral anastomosis, which I finally did accomplish. No bowel current was established, and I probably was mistaken in thinking I had got below and above the occlusion. The artificial anus remained open, and the patient gradually sank and died of marasmus.

CASE IV.—Ileus and tumor in right iliac fossa; diagnosis of tubercular disease of ileocæcal valve. Operation, recovery, and improvement of symptoms. Child, aged three and a half years, brought with diagnosis of appendicitis. Vomiting and obstipation for four days, tumor in right iliac fossa size of orange. In this, as in previous cases, the history was misleading in that the presence of the tumor was not known. The fact, nevertheless, must be that the tumor existed, and could have been found for a long period preceding.

I had been put on my guard by former experience, and on examining this mass thought at once that it was harder and less tender than an appendicular abscess. It was also somewhat more movable. Rather by exclusion I diagnosed this case as localized tuberculosis of the cæcum, and found on exploration that the mass was composed of thickened omentum, loops of bowel, enlarged appendix, and plaques or nodules in the peritoneal surface. The bowel adhesions were capable of being partly detached, the appendix was removed, and the field rubbed with iodoform emulsions and drained with iodoform gauze. This child recovered rapidly, and was much relieved. The tumor was reduced about one-half when last seen.

In none of these cases was it possible to resect the diseased part; but this is always the ideal method. No surgical operation is more satisfactory and curative than resection of parts of tubercular intestines at the valve. This operation should always be our preference.

Pathology.—I can add but little as to the pathological findings or the differential diagnosis. The tumors formed are dense, and the wall of the cæcum in reported cases as well as my own is of enormous thickness, causing more or less stenosis. The greatest stenosis, however, is at the ileocaecal valve, according to most observers. The mucosa is at first but little altered, but later ulcerated spots appear.

Diagnosis.—The differential diagnosis will probably have to depend upon the history in part, and, as these are emergency cases, the history given is often imperfect. With an accurate anamnesis, there would really be no difficulty in diagnosis, but this is seldom obtainable.

The differential diagnosis must be made from

- (1) Appendicitis.
- (2) Exudate and residuum.
- (3) Diseases of adnexa.
- (4) Intussusception.
- (5) Actinomycosis (common in colon).
- (6) Sarcoma and carcinoma.

Of these, but two—appendicitis and malignant disease of

the cæcum—are especially common, and in some cases not to be diagnosed before operation.

The treatment will often be an emergency operation, and will always be surgical by one of the following means:

(1) Laparotomy for simple exposure. This has the same value here as in other forms of tubercular peritonitis.

(2) Excision of omental masses and breaking up adhesions.

(3) Artificial anus.

(4) Partial resection of wall of cæcum or plastic operations thereon.

(5) Lateral anastomosis or "partial exclusion."

(6) Resection of cæcum or "total exclusion."

The resection of the ileum and cæcum has been done repeatedly, and is the ideal method of dealing with both tubercular and malignant ileocæcal tumors. The following table of results by various methods shows an encouraging percentage of cures by each. (Conrath.)

Method.	Cases.	Died.
Extirpation	58	11
Partial resection.....	6	0
Enteroanastomosis	10	0
Complete exclusion.....	8	2
Simple laparotomy.....	4	1
	—	—
	86	14
	16¼ per cent.	

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OBTURATOR HERNIA OF THE BLADDER AND OF THE FALLOPIAN TUBE.

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THE following is a description of two rare forms of hernia found in a female subject, aged seventy-eight years, in the Practical Anatomy Rooms of the Middlesex Hospital Medical School. The cause of death was certified as "morbus cordis."

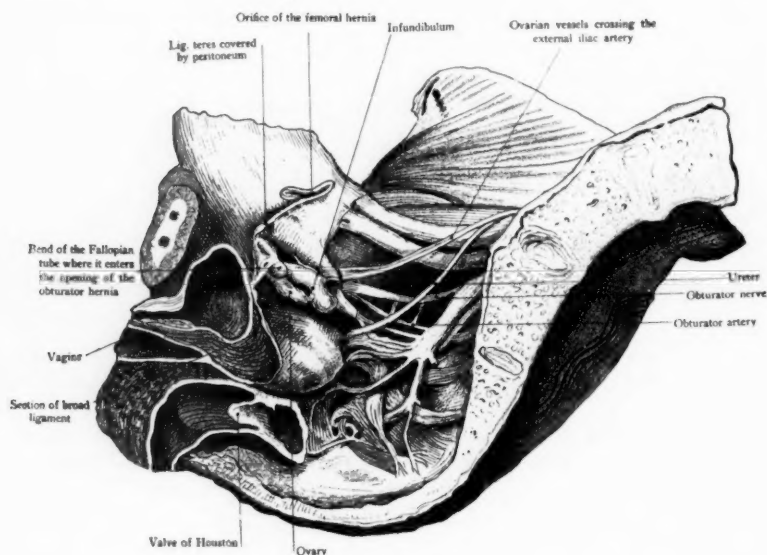


FIG. 1.

On the right side a "U-shaped" bend of the Fallopian tube (Fig. 1), with a portion of the mesosalpinx, was found lying within a small peritoneal sac (Fig. 2, s). This sac had escaped

from the pelvis through the obturator canal, and lay embedded in a mass of fat beneath the obturator externus muscle; it resembled in shape the end of a small test-tube, and measured 1.5 centimetres in length and rather less than 1 centimetre in width. Its



FIG. 2.—Obturator hernia of the Fallopian tube from the outside, showing the fatty mass which enveloped the hernia; this has been incised, and a glass rod inserted so as to expose s, the peritoneal sac covering the Fallopian tube. NN, branches of the obturator nerve. AA, internal and external branches of the obturator artery.

extremity was connected externally by a fibrous band with the connective-tissue septa of the lobulated fatty mass which covered it. This mass of fat, which was continuous through the obturator canal with the adjacent extra peritoneal layer of fatty areolar

tissue, lay immediately below the obturator crest, and was flattened out between the obturator externus muscle and the obturator membrane; it measured 2.5 centimetres in length and 1.5 centimetres in its greatest vertical diameter. The obturator nerve and vessels at the entrance of the obturator canal were to the outer side of the sac; at the crural end, the two branches of the nerve lay to the outer side (Fig. 2, NN), while the bifurcation of the obturator artery was situated below the hernia.

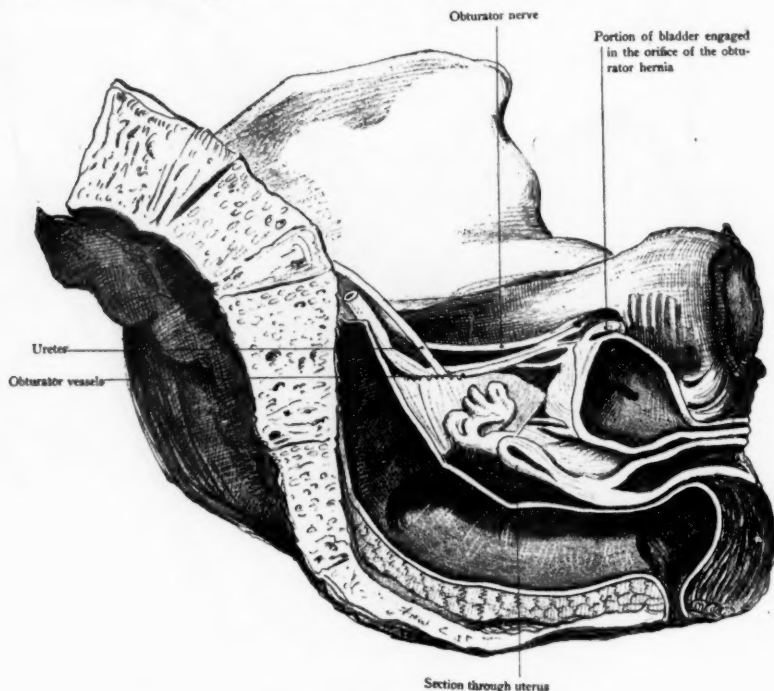


FIG. 3.

On examining the parts from the pelvic aspect (Fig. 1), the middle portion of the right Fallopian tube, with its adjacent mesosalpinx, was found lying within the sac. It was easily reduced, as there were no adhesions of any kind, nor was there any constriction. The length of the right Fallopian tube was nearly double that of the left; the right, measuring from the lateral angle of the uterus to the *ostium abdominale*, was 11 centimetres, the left 6 centimetres. The attached border of the right ovary, midway between the uterine and ovarian poles, lay close to the

orifice of the hernial sac, but the ovary was not actually engaged within it. On this side of the pelvis there was also a small femoral hernia, consisting of a sac 3 centimetres in length, containing a knuckle of small intestine. It did not extend beyond the crural canal, and the intestine was easily reducible.

On the left side of the pelvis (Fig. 3) a corner of the bladder



FIG. 4.—Obturator hernia of the bladder, seen from the exterior. L, fatty covering of the hernia, laid open. B, band of fibrous tissue connecting the lipoma with the herniated portion of the bladder. FB, ends of the cotylopubic band, which originally bridged across the hernia, and which has been cut. AA, branches of obturator artery. NN, branches of obturator nerve.

wall, situated anterior to the line of reflection of the peritoneum, was found to be firmly fixed in the commencement of the obturator canal; beyond this, and appearing outside the pelvis, was a pellet of fat having about the same form and size and occupying the same position as that on the right side (Fig. 4). It lay beneath the obturator externus muscle, and was divided superficially into two almost equal parts by a fibrous band, extending

from the surface of bone just below the pubic spine to the anterior margin of the cotyloid notch and the transverse ligament. A second flat band extended from the inner margin of the obturator foramen to the cotyloid notch externally, where it was attached to the transverse ligament just below the former; this band lay below the hernia, and bridged across the branches of the obturator artery. These bands are normally present, and sometimes form an imperfect membranous sheet lying superficial to the branches of the obturator vessels which lie in a layer of fat between this structure and the true obturator membrane. It has been described by Fischer as the "external obturator membrane," while the stronger and deeper layer he speaks of as the "internal obturator membrane." The structure, however, seldom exists as a continuous sheet; it usually occurs in the form of several flattened bands; the upper of these is the more constant and the stronger, and has been described by Testut (*Traité d'Anatomie Humaine*, Vol. i, p. 538) as "*le bandelette sous-pubienne*." To avoid confusion, however, with the subpubic ligament, which lies beneath the symphysis, it would perhaps be better to speak of this ligament as the *cotylopubic band*. It is sufficiently strong to give rise to strangulation of an intestinal obturator hernia, and from its position it is extremely liable to do so. An instance of this accident occurred in a case published by Fiaux. (*Gazette des Hôpitaux*, 1840, p. 580.)

The vessels on this side entered the obturator canal to the outer side of the herniated bladder, while the bifurcation of the artery at the crural end of the canal lay below and behind the hernia. The obturator nerve entered the canal above and to the outer side of the bladder; it bifurcated within the canal, and its two divisions passed out into the thigh above the fatty portion of the hernia (Fig. 4, NN). A few muscular fibres which were connected with the outer surface of the bladder were prolonged outward as a fibrous band, which lay embedded in the upper part of the fatty mass. This band was continuous with the connective tissue of the investing fat.

On making a mesial sagittal section through the pelvis, and thus opening the bladder, the hernia appeared from the inside as an elongated conical recess in the mucous membrane, the cavity of which turned upward and forward to the entrance of the obturator canal.

The bladder was of normal size, it showed no alteration in the thickness of its walls, and the mucous membrane appeared to have been healthy. The viscus, however, along with the uterus, was considerably displaced to the left, and the latter was much atrophied.

On examining the interior of the rectum, there were seen two valves of Houston in the lower part of the rectum, and a third much higher at the level of the second sacral vertebra. The middle valve (Fig. 1) was considerably thickened; it was attached to nearly the whole circumference of the gut, so that the passage here, which was behind and to the left, was extremely narrow.

I was unable to obtain any history of the case, and the herniæ were apparently unrecognized during life. It might be inferred, however, that the coexistence of three separate herniæ in the same subject was due, in part at least, to a common cause, namely, an augmentation of intra-abdominal pressure; and it seems probable that this increased pressure was due to straining during defecation, in order to overcome the constriction caused by the thickened valve.

Another condition which in all probability played an important part in the causation of the two obturator herniæ was the accumulation of fat in the prevesical region; a portion of this fat, which is in intimate relation with the bladder wall, and also continuous with the fatty areolar tissue lying between the two layers of the broad ligament of the uterus, must have been forced out through the obturator canal, beyond which it formed a lipoma. The latter had by its growth exerted traction on the bladder wall upon the left side, and on the peritoneum anterior to the broad ligament on the right side; on the left side there was produced a "lipocystocele," on the right a hernial sac, into which the Fallopian tube descended, either simultaneously with the development of the sac, or after its formation. An accumulation of fat in connection with herniæ of the bladder in the femoral and inguinal regions has been recorded by numerous observers, and its action in the development of these ruptures was first demonstrated by Cloquet, Roser, Monod, and Delaganière. It probably acts in

the same way upon the peritoneum which lines the pelvic and abdominal cavities as upon the bladder, and will thus, in combination with increased intra-abdominal pressure, produce a *preformed sac* into which intestine, ovary, Fallopian tube, or other viscera may descend. There is at the entrance of the obturator canal a yielding spot where the vessels and nerve surrounded by a layer of fatty tissue pass out from the pelvis. In the initial stages in the production of the hernia, a viscus is pressed against the orifice, and either enters it directly, as in the case of the bladder, or pushes before it the overlying peritoneum and fatty tissue; adhesions, which are sufficiently firm to prevent its withdrawal, are formed between the viscus or peritoneal sac and the surrounding structures, while the fat external to the canal increases in bulk so as to form a lipoma, which still further prevents reduction, and may by exerting traction even increase the size of the hernia. The formation of obturator herniæ is probably in all cases a slow process, and when strangulation occurs, it is most probably due to the sudden descent of a fresh portion of intestine into the sac of a pre-existing hernia which, prior to this occurrence, has remained unrecognized. The contraction of the urinary bladder during micturition would presumably, under ordinary circumstances, be sufficient to spontaneously reduce a recent hernia of any part of its wall. A condition, however, which it might be conceived would counteract this tendency, would be the force which a pregnant uterus or tumor might exert in pressing a portion of the bladder against the orifice of the obturator canal, and preventing this portion from taking part in the alternate physiological distentions and contractions which normally involve the viscus as a whole. After parturition, the bladder would be unable by its contraction to withdraw the herniated portion; partly owing to the formation of adhesions and partly on account of the connection of its wall with the lipoma which will have formed outside the pelvis. An atonic and dilated condition or a lateral displacement of the bladder are also almost necessary factors in the etiology and persistence of

this form of hernia. I am unaware of any case of obturator hernia of the bladder occurring in a man or in a nulliparous woman, although obturator hernia of the intestine may occasionally occur in both. The recorded cases of obturator hernia of the bladder, however, are too few to draw any conclusion as to the influence of pregnancy in the causation of the displacement.

Obturator hernia of the bladder is an extremely rare condition. I have been unable to find a specimen of such in any of the museums in London; and, although it is stated to have occurred in several text-books and monographs on hernia, I have been unable to find a single detailed account of the condition. Englisch, J. (*"Ueber Hernia Obturatoria,"* Wien, 1891), gives references to six cases, which I have included in the subjoined list; but I have been able to obtain access to only one of these, viz., that described by Dr. Hahn in Schmidt's *"Jahrbuch,"* 1840. In this case there was a femoral hernia on both sides; on the right, the fundus of the bladder is stated to have been in front of or opposite (*"vor"*) a much dilated obturator canal, and that there thus existed a cystocele of the foramen ovale. Dr. Hahn is said to have reported two cases. I find, however, no reference to his second case, and, since the first is recorded also in another paper, it is quite possible that the original case was mistaken for a second. In a case of strangulated hernia of the intestine with perforation, described by Blazina, several coils of the intestine were freshly adherent to the bladder, and lay opposite the orifice of the obturator canal. The case is interesting, as showing a possible method by which an obturator hernia of the bladder might be produced. The bladder has, as is well known, been frequently dragged down into a femoral or inguinal hernia by the traction exerted on the peritoneum by coils of intestine which have previously descended; and in these cases the peritoneum on the posterolateral aspect of the bladder has often formed the inner wall of the hernial sac.¹

¹ An interesting article on hernia of the bladder has been published by Dr. Friedrich Brunner, in which he fully discusses the etiology of vesical hernia, and in which numerous references will be found to the literature

Obturator hernia of the Fallopian tube is apparently much more frequent, and it is often associated with hernia of the ovary or intestine. In a case described by U. Krönlein, a woman, aged seventy, was operated upon for a strangulated obturator hernia on the right side, which contained a coil of small intestine, the uterus, the right ovary, and the right Fallopian tube.

A large proportion of cases of obturator hernia, whatever the nature of their contents, are, like the instance which I have described, bilateral. At least seven such cases have been reported, namely, those of Bowlby, Camper, Chiene, Hilton, Klinkosch, Richmond, and Wagner.

Obturator herniæ of all kinds are found very much more commonly in women than in men; according to J. Macready ("Treatise on Ruptures") there were only four cases in males out of a total of sixty-three. They occur most frequently in women who are over sixty years of age, and it is said to be most common in those who have previously been stout, but have rapidly lost flesh.

A somewhat similar case to the one which I have described was published by Dr. J. Chiene in the *Edinburgh Medical Journal*, 1870-71, Vol. xvi, p. 601.

This was a double obturator hernia associated with an old femoral hernia. On the left side, the hernia through the obturator canal contained a strangulated portion of the ileum and the outer two-thirds of the Fallopian tube of that side; the sac was formed by the peritoneum of the broad ligament, and outside the pelvis the obturator artery was separated from the neck of the sac by a transverse ligamentous band derived from the thyroid membrane. On the right side of the pelvis there were two hernial sacs; one lay above and in front of the round ligament of the uterus in the upper part of the obturator canal, while the other lay below this ligament and passed through the lower part of the canal. The upper sac was empty, and the lower contained the

on the subject. He makes no mention, however, of obturator hernia of the bladder, although his statistics were drawn from 181 cases. ("Ueber Harnblasenbrüche," Dr. Friedrich Brunner. *Deutsche Zeitschrift für Chirurgie*, Band xlvii, Seite 121.

outer half of the Fallopian tube. There was also on this side, the right, a puckered scar in the peritoneum opposite the crural canal, indicating the position of a femoral hernia which had previously been operated upon.

The number of cases of empty hernial sacs occupying the obturator canal, as compared with the total number of cases of obturator hernia, is as one to six; a circumstance which is strongly in favor of the view which I have described above of the method by which these herniæ are developed.

Another interesting case¹ was described by Rogner-Gusenthal. This was a strangulated obturator hernia upon the right side, which also contained the right ovary and Fallopian tube, both of which were gangrenous. On the left side, at the entrance of the obturator canal, there was a small peritoneal sac, which would admit the point of the little finger. The case had been operated on under the belief that a strangulated femoral hernia was present. A fluctuating swelling was found beneath the pectineus, and by dividing this muscle longitudinally there was exposed a hernia which was of the size of a hen's egg. The sac was free as far as the obturator canal, where the neck was found to be constricted between the bone and the moderately sharp upper border of the obturator membrane. On opening the sac its contents were recognized, and an attempt was made to establish an artificial anus. The woman, however, died on the fifth day after the operation. In discussing the operative treatment of these cases, Gusenthal gives decided preference to the intra-abdominal method, laying especial stress upon the difficulty of the extra-abdominal operation, owing to the depth of the wound and the proximity of the femoral vessels.

In a case like the one which I have described the diagnosis would be extremely difficult. There would be no tumor felt externally, and the recognition of its nature would depend mainly on the occurrence of pain, or perhaps numbness in the course of the obturator nerve; this may be complained of by the patient, or the pain may be elicited by pressure made in a backward direction below the obturator crest; or from the

¹ For the reference to this case, I am indebted to Mr. J. Bland Sutton.

inner side of the thigh, behind the origin of the adductor longus muscle, in a direction towards the obturator canal (Howship-Romberg symptom). Pain in the course of the obturator nerve may also in certain cases of obturator hernia be brought out by putting the obturator externus muscle upon the stretch; this may be done by strongly adducting the limb, and at the same time rotating the thigh inward.

The hernia of the bladder would also most probably have given rise to dragging pains in the region of the bladder and to some frequency of micturition. Obturator hernia has in a few cases been detected by examination per vaginam or per rectum; and by means of traction exerted through the vagina Werner even succeeded in *reducing* an obturator hernia.

The operative treatment of obturator hernia may be considered under two heads, viz., the intra-abdominal operation and the extra-abdominal operation. In either method the operation would in the first instance be most probably of an exploratory nature. The case which I have described could have been easily dealt with by the intra-abdominal operation, through a single median incision, in the linea alba. If, however, the rupture of either side had been unaccompanied by the other, it could have been reached by a single incision from the exterior; and, although from the depth of the wound, and the proximity of the femoral vessels, it would have been more difficult to expose the hernia by this method, the sac and its coverings, or any constriction by the cotylopubic band, could most certainly have been treated in a more satisfactory manner than from the inside. This method would also be preferable in a case of strangulated obturator hernia of the intestine in which it was necessary to form an artificial anus, since the condition could be dealt with without breaking down any adhesions which would have formed at the neck of the sac. In conclusion, I will draw attention to two points of interest in connection with the surgical anatomy of obturator hernia. Firstly, an obturator hernia never receives any covering from the pelvic fascia, since the upper line of attachment of the obturator portion of this fascia passes below the obtu-

rator canal, where it forms, by blending with the upper border of the obturator membrane above the obturator internus muscle, the lower boundary of this passage. The vessels or any hernia thus pass through without having to pierce the fascia; and, secondly, the obturator artery bifurcates, and the two branches of the obturator vein unite in nearly all cases immediately below the neck of the sac; consequently, it would be necessary in dealing with a case of strangulated obturator hernia of the intestine, should the constriction be caused by the upper border of the obturator membrane, to use the same precautions in notching this border as are used in relieving a strangulated femoral hernia. A single, free incision in a downward and inward direction would most certainly divide the vessels.

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NOTE ON X-RAY BURNS AND THEIR TREATMENT.¹

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THE term "X-ray burn" is coming to be regarded as a misnomer. According to Rudis-Jacinski, this lesion consists in an acute, subacute, or chronic necrobiosis. Etiologically it depends upon irritation of the peripheral sensory nerves with secondary paralysis of the vasomotor system of affected areas. Spasmodic contraction of arterioles follows, cell nutrition is impaired, and necrosis is the logical result.

Gassman and Schenkel, after exhaustive study of a case in which a peculiar progressive gangrene appeared four weeks after exposure, concluded that the process began in the centre of the affected area, and did not invade the outer limit until four months later. During this time there was persistent though almost imperceptible progression.

It was found that the intima of the arterioles and veins, especially of the latter, were appreciably thickened and the lumen correspondingly narrowed. This, it is claimed, is due to a deposit of reticular masses of delicate fibrous tissue. Similar processes were noted in the membrana elastica and muscularis. From the same source we learn that the deeper vessels continue to perform their function imperfectly while undergoing the degenerative process.

This is the clearest elucidation of the changes occurring in this provokingly obdurate affection thus far offered, and throws much light upon its slowly progressive character.

Authorities very generally are agreed that medical treatment of radiographic ulcers is most unsatisfactory, if not alto-

¹ Read before the San Francisco Academy of Medicine, August 27, 1901.

gether inefficient. From the surgical stand-point it must be borne in mind that we are confronted by a slowly progressive degenerative process, which both superficially and vertically is without definite limitations. Symptoms attributable to hyperæsthesia of the affected area are of some value; but evidence referable to this source is unreliable owing to tardy encroachment upon what had seemed previously healthy tissue.

It follows, therefore, that if excision of the ulcer be determined upon, it must be performed with extreme boldness, to the end that all tissue supplied by defective blood-vessels be removed.

The following case, treated by excision and skin-grafting, illustrates the value of this suggestion.

L. D. F., a millwright, aged thirty-five years, is a man of medium height, thick-set, and weighed at time of injury 168 pounds. During the month of October, 1900, he was subjected to the X-rays several times, the exposure being over the right rectus muscle, above the umbilicus. As a consequence, there appeared an extensive dermatitis over an area the size of a tea-saucer. In the central portion of this surface there gradually developed an incorrigible ulcer involving the integumentary structure and, as later developments proved, the subjacent layer of fat. The patient fell subsequently under the care of Dr. D. W. Montgomery, who demonstrated the lesion before the California Academy of Medicine, April, 1901. At that time there was an elliptical area of skin necrosis, whose dimensions were three and one-half by two and one-half inches. It presented a dull gray, mottled appearance. It was slightly moist, sluggish, and parchment-like to the touch. Surrounding the ulcer there was a hyperæmic zone, which faded gradually at its outer margin. The patient complained of intense itching, which at times was unbearable. At the junction of the necrotic and hyperæmic areas there was marked hyperæsthesia, and over the entire surface pain was a constant factor.

Through the courtesy of Dr. Montgomery, the case came under my care May 9, 1901, and the following day entered the hospital. For two days strong antiseptic lotions were applied as a preliminary to operation. On May 12, under chloroform anæs-

thesia, the ulcer was circumscribed by a deep incision, extending through a thick layer of fat to the sheath of the right rectus. In dividing the layer of fat, it offered so much resistance to the knife as to suggest an abnormal condition of that tissue. Accordingly, the marginal fat was also removed for a considerable distance from the periphery of the original incision, the overlying skin being left as a loose flap. This flap was then carefully sutured to the sheath of the rectus, and, to secure a better lodgement for the grafts, the exposed sheath was removed up to the suture line. Upon the belly of the rectus, skin-grafts, after the method of Thiersch, were adjusted, and the wound was dressed with silver foil and dry aseptic gauze.

The patient made an uninterrupted, quick recovery. The recovery seems to have been permanent, and he makes no complaint save of hypersensitiveness of a small area below the lower segment of the cicatrix. At this joint the skin is slightly reddened, but there seems no tendency to necrosis, although the patient has been roughing it in the mountains for several weeks.

The only feature of the case worthy of further comment is a keloidal ring encircling the grafted area following the line of sutures.

Incidentally, I wish to allude to the value of silver-foil dressing for Thiersch grafts. It is dry, aseptic, and mildly antiseptic; but its chief value seems to lie in its efficient prevention of adhesion of the gauze to the grafts.

CONTRIBUTION TO THE SURGERY OF TRUE CYSTIC KIDNEY.

By J. NIEMACK, M.D.,

OF CHARLES CITY, IOWA.

CYSTS in the kidney and true cystic kidney are as yet not kept sufficiently separate in surgical literature.

There is no doubt that a number of cases have been observed in which one or two cysts only were found in one kidney; but there is another class of cases (some of them found in new-born babes) in which the whole kidney substance is a conglomeration of large and small cysts separated by intraligamentous tissue. In the latter case it seems that always both kidneys have shown the same affection, although in different degree.

In solitary cysts, nephrectomy has been successfully supplanted by excision of the cysts.

But there is as yet no consensus of opinion as to the treatment of true cystic degenerated kidney and its complications. For this reason any new case contributed may prove of some value.

Mrs. F. had been under my care for different little ailments for about four years. She was a Scandinavian, aged forty-three, a tall, slender woman of somewhat neurotic disposition, never seriously sick. On the 4th of August, 1900, I saw her for climacteric menorrhagia, which gave me the first opportunity for a physical examination. Then incidentally I found a smooth kidney-shaped tumor below her liver which could be easily palpated, was freely movable, slightly tender, and seemed but a trifle larger than the normal kidney.

The patient seemed to have known nothing about it, and only when questioned admitted that she had noticed some irregularity

of urination, and quite frequently had a dull ache in her right side and back. She was not ready to accede to the suggestion of nephrorrhaphy. Her urine at that time did not show any anomaly. She decided to wear an abdominal supporter.

November 3, three months later, she suddenly had several slight chills with a severe pain right below her liver. I found her in an unmistakably slightly septic condition, very restless, with a temperature of 103° F. and a poor pulse of 100; no albumen in the urine. The tumor had increased to twice its former size. It had a nearly transversal position; the part of it adjoining the liver was tender in a high degree. The surface of the tumor had now several elevations of nearly walnut size.

On the 4th her urine was cloudy and contained a trifle of albumen; the sediment consisted of some mucus and pus, plenty of cells from the kidney pelvis, bacteria, and some red corpuscles. No other characteristic substances. She was at once removed to the City Hospital. Her color became more and more of a yellowish gray hue, temperature kept vacillating between 101° and 103° F., pulse between 88 and 110; she felt rather prostrated and without energy. Her urine was always clear, specific weight 1015, no albumen. The combination of her present condition with her former history caused the following diagnosis: floating kidney, twisted pedicle, cystic degeneration, and septic infection. The possibility of a malignant tumor-formation on the kidney could not be perfectly excluded.

Extirpation of the kidney was advised and finally accepted. On the 7th of November an exploratory incision into the abdomen was made, the diagnosis verified, and the left kidney was felt to be in its normal position, apparently of normal size and shape. After closing the abdominal incision, the kidney was reached through an oblique incision from the last floating rib to the spina iliaca superior posterior. The muscoli obliqui abdominis had to be incised to develop the large tumor. The other muscles were separated bluntly.

The pedicle showed up in the lower part of the wound; vessels and ureter were separately tied and the wound closed with drainage. The total loss of blood was about one ounce. The patient rallied well from the chloroform narcosis; five hours later the catheter voided two ounces of clear urine of specific weight of 1010. After a good night's rest, she spontaneously urinated

thirteen ounces of the same quality. Her temperature at this time was 100° F., with a pulse of 96.

Twenty-six hours after operation she vomited; the amount of urine grew less, vomiting continued at long intervals, venesection, repeated saline infusions, strychnine, and pilocarpine hypodermics were of no avail. The pulse rose to 110, while the temperature dropped below 97° F. She grew comatose, and sixty-two hours after operation she died. No post-mortem.



Sagittal cut, showing the largest cysts to be in both ends, the intermedial layer containing the largest ones. The specimen is somewhat contracted by being kept in alcoholic preserving fluid.

The condition of the extirpated kidney is best shown by the following illustration from a photograph (see Figure).

The kidney pelvis was considerably contracted. The different cysts had no connection with each other, and were separated on the surface by larger and smaller areas of apparently healthy kidney tissue. Some of the cysts contained clear fluid, others were hæmorrhagic; a great number contained a substance like diluted pus. The size of the organ was seven and a half by four inches.

According to the statements made by other observers, we are justified in supposing that the other kidney was the seat of a similar degeneration.

An analogous case is published by Carl Beck in the February number, Vol. xxxiii, of these ANNALS, page 147. His patient survived ten days, finally to die from uræmia.

The picture given by him seems to indicate that his case was farther developed than mine, establishing the old rule that the danger of nephrectomy decreases the more before operation the remaining kidney has become accustomed to do an increased amount of work.

The important features of our case are the following: The surprisingly rapid development simulating malignancy; the absence of nearly all clinical symptoms of floating kidney; the absence of all pathological conditions in the urine during the last sickness, with just *one* single exception, and upon which exception was based the diagnosis that there was not a malignant tumor, but retention of septic material in the kidney.

If strangulation of the ureter and septic infection, the latter probably caused by the colon bacillus, as there were no traces of cystitis, had not intervened, this same kidney, floating as it was and with cystic disposition, would probably have preserved its size, smooth surface, and activity for quite a while. Strangulation followed by retention of urine under pressure has in our case dilated the small cysts and not the kidney pelvis; so, instead of getting pyelitis, we had the cysts dilated by urine and infected by pus—cystopyonephrosis.

I think we may draw the conclusion in analogous cases that the kidney tissue and the cyst walls offer less resistance than the fibrous structure of the kidney pelvis.

In a case less accessible to palpation than ours, it can happen that the surgeon, prepared by the clinical symptoms to operate for typical pyonephrosis, will find conditions very different from what he had expected. It may be stated here as very important that the exploratory laparotomy and palpation of the other kidney give no positive information as to its condition, neither would ureteral catheterism. In every case of

true cystic kidney, we shall have to take into account the strong suspicion that the other kidney under the strain of increased work will develop the same degeneration; so, as a matter of fact, nephrectomy for cystic kidney will nearly always mean death. I realize that if nephrorrhaphy had been performed at the time suggested, the final complications would have been prevented, and I am convinced from this experience of the perniciousness of waiting.

Now, if not nephrectomy, what other kind of proceeding should have been followed out in our case, where the strangulation, sepsis, and pain required prompt and efficient action? Beck's suggestion of having the single cysts opened will prove to be impossible for execution, as his picture shows as well as mine. So I suggest, in a case like this, to remove the twist, to split the kidney substance down to the pelvis, stitch the organ up into position, and drain with plain gauze. A great part of the septic material will so find an outlet, and the large cysts in the centre will be obliterated.

Another case, which recently came to my knowledge,¹ where a woman of fifty years had been living for over twelve years with highly developed bilateral cystic kidneys and died accidentally after an exploratory laparotomy, shows for how long a time such kidneys can do a goodly amount of work.

¹ *Northwestern Lancet*, 1901, p. 227. Dr. Brackett is evidently very far from the facts if he considers the bilateral affection in his highly interesting case as unique. As mentioned above, it is the terrible rule.

URETERAL ANASTOMOSIS.

REPORT OF A SUCCESSFUL CASE.

By WILLIAM K. TURNER, M.D.,

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DEMONSTRATOR OF SURGERY, HOSPITAL COLLEGE OF MEDICINE; GYNÆCOLOGIST
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THE limited number of cases of ureteral anastomosis that have been reported make each and every case, successful or otherwise, a valuable contribution to medical literature, owing to the fact that so far there have been nearly as many methods advocated as there have been operations. Therefore, we are led to infer there can be no common method applicable to all cases, but, as in other branches, each case, to a certain extent, must be a law unto itself.

The case I now report is somewhat unique, not because of a new theory I have to advance, but simply on account of attendant circumstances.

Katie F., aged thirty-six years, married, white, mother of one child, was admitted to the Louisville City Hospital, May 26, 1900. The examination revealed complete prolapse of the uterus and bladder, the uterine cervix hypertrophied and badly eroded, both uterus and bladder protruding outside the vulva. June 26, one month after admission, I did a vaginal hysterectomy.

After having removed the uterus and adnexa, I discovered that I had accidentally divided the left ureter about two inches from the bladder. At first I mistook the ureter for a vein, but upon investigation found that the distal portion opened into the bladder, and from the other end the occasional drop of urine convinced me with what I had to deal.

At once I resolved to unite the ends after the method of Van Hook, but in attempting to dissect and bring down the proximal segment it was split the distance of about an inch, thereby increasing the interval between the ends and correspondingly increasing the difficulty of uniting them.

At this stage in the operation the advisability of opening the abdomen above and uniting the ends through a ventral incision presented itself, but, as the patient had now been on the table for over an hour, I determined on another trial by the vagina.

As the upper segment was already split, I decided to reverse the method of Robinson by implanting the lower into the upper segment, which I accomplished by passing a curved needle armed with a ligature through the wall of the lower segment; then the needle was introduced into the lumen of the upper portion for about an inch above the split and brought out through the wall of the ureter and surrounding structures onto the peritoneal surface. The needle was then taken off, and the suture caught with a pair of forceps. The needle was now threaded onto the other end of the suture, passed again into the lumen of the upper segment for the same distance, and, as before, brought out through the ureteral wall and adjacent tissues onto the peritoneal surface about three-quarters of an inch external to where the needle was brought through the first time. Now, by traction on the two ends of the suture, the lower segment was invaginated into the upper to where the suture passed through the wall of the upper portion. The ends of the suture were now tied, thus holding the segments invaginated while the anastomosis was completed with fine sutures. The joint thus made was reinforced by a covering of peritoneum. The vagina was packed with gauze, and the patient put to bed in a fairly good condition, with orders for strict attention to be paid to the dressings, as I fully expected leakage.

Eight hours after the operation she was catheterized of eight ounces of urine, which suggested that the repaired ureter was doing its duty. The patient made an uninterrupted recovery, leaving the hospital five weeks after the operation.

One year has elapsed since the operation, and the patient is quite well.

I have made a thorough investigation of the literature on this subject, and believe this to be the first case reported in

which the anastomosis has been made through the vagina, and where the lower segment was implanted into the upper.

I consider it necessary to state that I believe, unless the bladder had not been pulled down by the uterus, and the ureters stretched by constant tension of years, it would have been impracticable to restore the continuity of the ureter in this way.

STONE IN THE BLADDER OF A FEMALE CHILD OF FOUR YEARS.

By MILES F. PORTER, M.D.,

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WAYNE COLLEGE OF MEDICINE.

I WAS first called to see baby A. when she was not quite six months old, on account of severe paroxysms of pain. These attacks were for a time considered by the mother to be of intestinal origin. Careful inquiry and observation led to a suspicion of renal colic, which suspicion was confirmed in a short time by the passage of calculi per urethra.

She had frequent attacks of this trouble during the succeeding two years, during which time she passed fully a teaspoonful of calculi, ranging in size from a millet-seed to a large wheat grain.

At the end of this time (she was then two and a half years old) the attacks of colic ceased, and she seemed to be in good health, save that she urinated quite frequently, until April 14, 1901, when I was called to see her, and learned from her mother that for some days she had been having attacks of pain, etc., when passing her urine. These symptoms I thought due to a stone in the bladder. Under ether the bladder was sounded and the diagnosis confirmed. She was taken to Hope Hospital, and after preparation was operated on April 16, 1901. She was on the date of operation three years, ten months, and twenty-five days old. A suprapubic cystotomy was made, and a single ovoid stone weighing (when thoroughly dry) sixty grains and measuring seven-eighths inch in width and three-eighths inch in thickness was removed. The bladder was sutured immediately with catgut and the external wound closed with silkworm gut. A very small gauze wick was left in the lower angle of the wound reaching to the bladder. This was removed in forty-eight hours. The blad-

der was drained for five days by a catheter kept in the urethra. The child went home well on the twelfth day after the operation.

The age and sex of the patient, the size of the stone, and the immediate closure of the bladder are the points of particular interest in this case, and seemed to me to be of sufficient importance to warrant its publication.

According to Coulson,¹ the relative frequency of vesical stones in females as compared with males is 5 per cent. Prout² puts it about the same, while Klein,³ in Russia, puts it at one-fifth of 1 per cent. The older idea that vesical calculus is more common in children than in adults is now known to be incorrect, according to Thompson.⁴ Of his cases, 933 were adult males, seventeen were children, and fourteen women, out of a total of 964 cases.

Nephritic calculi are not so infrequent relatively in females as compared with males as are vesical calculi. Nephritic calculi are not relatively so rare very early in life as are vesical calculi. Southworth⁵ presented the New York Pathological Society with the kidney of a new-born child containing calculi; Hance⁶ records the discovery of a calculus in the kidney of an infant twenty months old.

Dr. Arthur V. Meigs⁷ has in his possession a calculus removed post-mortem from the kidney of a child of six months. In none of these cases is the sex given. Troiski⁸ extracted a uric acid stone weighing twenty-five centigrammes from the urethra of a male infant one month old.

Southworth thinks it probable that not infrequently the crying spells children have, which are attributed to colic, are due to nephritic calculi. The history of the case herewith reported tends to confirm this opinion.

In the literature at my command I can find no case reported of vesical stone in the female occurring in so young a patient as the one whose history is given above. E. L. Keyes⁹ reports a case of litholapaxy in a female child of four years.

Immediate closure of the bladder is not often done after removal of stones. That this method could be adopted with advantage much oftener than it is, I have no doubt.

In my judgment, it should be adopted in all cases, either male or female, of suprapubic cystotomy for stone, unaccompanied by severe cystitis. In female patients it should be resorted to in all cases save those accompanied by very severe cystitis. Continuous catheterization should be resorted to in all cases in which immediate cystorrhaphy is done. It should be kept up longer in males, other things being equal, than in females, and longer in cases of severe than in cases of mild cystitis.

¹ International Encyclopædia of Surgery, Vol. vi, p. 154.

² Loc. cit.

³ Loc. cit.

⁴ ANNALS OF SURGERY, Vol. xii, p. 385.

⁵ Annual of Universal Medical Science, 1895, Vol. i, F. 25.

⁶ Annual of Universal Medical Science, 1891, Vol. i, L. 41.

⁷ Keating: Encyclopædia of Diseases of Children, Vol. iii, p. 596.

⁸ Loc. cit., p. 597.

⁹ International Encyclopædia of Surgery, Vol. vi, p. 212.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 22, 1901.

The Vice-President, F. KAMMERER, M.D., in the Chair.

STRICTURE OF THE ŒSOPHAGUS.

DR. THEODORE DUNHAM presented a boy, three years old, who, in May, 1900, swallowed a solution of caustic potash, which resulted in the formation of an œsophageal stricture located about five inches below the teeth. After repeated unsuccessful attempts to pass instruments beyond the point of stricture, the child was admitted to the Babies' Wards of the Post-Graduate Hospital; and on December 21 last Dr. Dunham opened the stomach and made an unsuccessful attempt to pass an instrument upward into the œsophagus. About a fortnight later he made a second attempt, and again failed. Subsequently, Dr. Dunham succeeded in passing a thread from the mouth to the stomach by getting the child to drink water through an ordinary glass drinking-tube which was first threaded with common black thread. As the child drank the water, the thread gradually passed down the throat, and after a number of feet had disappeared the lower end of it was caught and drawn out through the gastrotomy wound. A whale-bone filiform bougie was then tied to the lower end of the thread and drawn up through the œsophagus. By the same method an effort was then made to draw up one of the bougies designed by Dr. Abbe for cutting strictures in this region; but this proved unsuccessful, as the instrument could not be made to engage in the cardiac orifice of the stomach. Dr. Dunham then devised an instrument made of a piece of piano wire which carried a number of pieces of metal, spindle-shaped; these pieces of metal were fastened to the wire, several inches apart, and of gradually increasing size. The wire was drawn up through the

œsophagus by means of a piece of thread, and then pulled back and forth through the strictured area. In order to guard the soft parts of the stomach and pharynx from injury by the wire, it was passed, above and below, through tubes of aluminum, which were first properly bent.

After the stricture had been dilated by this method to a calibre of No. 30 F., œsophageal bougies with a conical metal tip were substituted. These bougies were hollow, and to guard against their doing injury to the soft parts they were passed upon a thread running from the pharynx to the stomach.

A No. 30 F. bougie is now passed at intervals, and the child is able to eat everything without distress. The opening made in the stomach is gradually closing.

PARACENTESIS OF THE PERICARDIUM.

DR. OTTO G. T. KILIANI presented a youth, sixteen years of age, who was admitted to the medical side of the German Hospital February 5, 1901, in the fourth week of an attack of acute rheumatic polyarthritis. He began to develop signs of subacute endocarditis and acute pericarditis on February 23. On February 27 the cardiac dulness was highly increased, marked dyspnœa existed, respiration 56, pulse about 160.

On that day an exploratory puncture through the third intercostal space on the left side was made, and fifteen cubic centimetres of serofibrinous fluid removed. Immediately after that, under local cocaine anæsthesia, the cartilage of the fourth rib was resected to the extent of about an inch and a half, and a horizontal incision of the pericardium for about an inch made, followed by a gush of serosanguinous fluid. No difficulty was experienced in avoiding the pleura. Not very marked foaming. Iodoform gauze tamponade. About an hour after operation, the dyspnœa was markedly relieved and the pulse had come down to 112. Temperature went down from 103.6° to 101° F. Practically uneventful recovery up to March 12, when patient was removed to the Isabella Home, where he still is. He still shows his mitral lesion, but is otherwise well.

Reichard, in the second and third numbers of Vol. vii of *Mittheilungen aus den Grenzgebieten der Medicin und Chirurgie*, gives a casuistic report of operations for pericarditis, where he has collected, up to 1900, thirty-three operated cases, nineteen of

which were executed without resection of the rib. The death-rate for the thirty-three cases is 57.6 per cent.; for the nineteen without resection, 68.4 per cent., and of the fourteen with resection, 42.9 per cent. The number of cases being so small, the statistics are not of very high value.

UNILATERAL LARYNGECTOMY.

DR. KILIANI presented a man, fifty years of age, who had been hoarse a year previous to his admission to the German Hospital on February 4, 1901. He was then able only to whisper, and showed considerable dyspnoea. The diagnosis of epithelioma had been made by Dr. J. W. Gleitsmann after intralaryngeal removal of a small piece of the tumor for microscopical examination.

The patient being opposed to a radical operation, on February 7 a laryngo fissure was made, under local cocaine anaesthesia, in the inclined position with lowered head. All growths situated below the vocal chords on the right side (the left side being free) were removed with knife and scissors and Paquelin's thermocautery. Suture of the wound. Slight infiltration of the line of incision followed; nevertheless, the wound healed. On the 26th of February, when dyspnoea had become quite marked again, the intralaryngeal inspection showed recurrence of the growth on the right side. As the patient refused total extirpation, not wanting to lose his voice, unilateral laryngectomy was performed on the 28th of February. This was again done with hanging head under local cocaine anaesthesia. Complete bony union of the thyroid cartilage had occurred. The hæmorrhage was controlled during the operation by the use of suprarenal extract. As the wound was perfectly dry, it was closed entirely by sutures. Shortly after having been brought to bed, the patient got quite a profuse hæmorrhage, which necessitated the reopening of part of the wound and insertion of a cannula, surrounded by iodoform tampons, which was removed on the second day. Uneventful recovery. Dismissed on the 24th of March with good voice.

The intralaryngeal inspection to-day showed the larynx free, but at the incision outside a carcinomatous infiltration and ulceration are visible, to which the patient, having developed meanwhile carcinoma of the glands of the neck and refusing farther interference, will probably soon succumb.

Dr. Kiliani said he was inclined to attribute the secondary

hæmorrhage in his case of unilateral laryngectomy to the suprarenal extract, which was given in powder form for the purpose of controlling the bleeding. It apparently had the effect of contracting the vessels; the wound was perfectly dry when it was closed, but soon afterwards a very severe hæmorrhage took place and a portion of the wound had to be reopened. In future cases of this kind, Dr. Kiliani said, he would not use the suprarenal extract, but would control the bleeding with a soft rubber tube and suitable packing. Possibly the cocaine was also partially responsible for temporarily checking the hæmorrhage.

SEPTIC ARTHRITIS OF KNEE; MAYO'S OPERATION.

DR. GEORGE E. BREWER presented a man, aged thirty-eight years, who was admitted to Roosevelt Hospital in December last suffering from a penetrating wound at the left knee-joint. It was impossible to gather any definite idea as to how the injury occurred, as the patient's recollection did not extend over that period. It seems, however, that he was injured during the night, and for several hours after the injury lay in a semiconscious condition on the ground. When brought to the hospital by the ambulance, he was somewhat dazed, but stated that the injury had occurred as the result of a collision with a truck. On examination there was a ragged wound just below the patella, which had completely severed the patellar ligament and opened the synovial cavity. Under chloroform anæsthesia, the joint cavity was thoroughly irrigated with salt solution, which was followed by a weak carbolic solution, the final washing being with salt solution. Two or three counteropenings were made and drainage tubes inserted. The patellar tendon was sutured with chromicized catgut and the cutaneous wound united with silkworm gut. The ordinary dressings were applied, and the leg was firmly bandaged to a posterior splint.

The following day the patient complained of considerable pain in the region of the joint, which was accompanied by a sharp rise in temperature. The dressings were changed and the joint again thoroughly irrigated every few hours. As no amelioration in the symptoms occurred, and as there was a marked leucocytosis present, with other symptoms of a progressively increasing sepsis, together with symptoms of an acute inflammatory process in the joint, the joint was thoroughly opened by a semicircular in-

cision and the patellar tendon was divided, also the crucial ligaments of the joint, after which the leg was flexed and the large anterior flap drawn backward on to the thigh, exposing the entire synovial pouch. This was thoroughly irrigated with a dilute solution of formalin followed by normal salt solution and a wet dressing applied.

The leg was retained in an acutely flexed position by means of a wire splint so arranged that the dressings to the exposed joint surface could be frequently changed. For several days following the operation there was apparently no improvement in the patient's symptoms. An induration appeared in the popliteal region which was sensitive to the touch, and was found to be a collection of pus behind the bone. This was opened, and drainage tubes passed from the anterior to the posterior region of the joint between the heads of the bones. This effectually prevented an extension of the local process. The general sepsis, however, was not improved by these measures, and for a period of some six weeks the patient exhibited the evidences of a grave sepsis, including an attack of pneumonia. The temperature, however, gradually fell to normal, and after six weeks, when all evidence of local affection in the joint had subsided, an attempt was made under chloroform anæsthesia to straighten the limb. In order to accomplish this, it was necessary to resect the articular surfaces of both bones. After this was done the leg was extended, the entire synovial sac thoroughly curetted, and treated with a solution of formalin 1 to 50. The cutaneous wound was partly united, several large areas being packed with sterile gauze. The leg was then encased in a plaster-of-Paris splint.

At the first dressing considerable pus was found in the portions of the wound drained by the gauze. During the eight weeks which followed, several small collections of pus situated under the skin were evacuated and the wounds dressed with various stimulating applications. The bones united promptly, and at the end of fourteen weeks the patient was able to be up and about the ward. His improvement since then has been very rapid and satisfactory.

This method of treating acute septic arthritis of the knee-joint was suggested to the profession by Dr. William J. Mayo, of Rochester, Minnesota, and is applicable to those cases in which the septic process has not only destroyed the joint, but has also

threatened the life of the individual, and in which amputation has hitherto been the treatment advised.

DR. HOWARD LILIENTHAL said he could add his testimony to the value of Mayo's operation, which should always be tried in these cases before an amputation is decided on. A German surgeon has advised the same method of treatment in severe septic conditions of the elbow-joint.

PRIMARY CARCINOMA OF THE KIDNEY.

DR. BREWER presented a man, aged thirty-nine years, who first consulted him in March, 1900, when he stated that for a period of one year he had experienced occasional attacks of hæmaturia without pain or discomfort. About six months before he had consulted his family physician during the interval between attacks and was thoroughly examined with negative result. He was, however, instructed to report if another hæmorrhage occurred. About one week ago he noticed on voiding urine in the morning that it was decidedly red. He at once went to his family physician, who found upon examination that the red discoloration was due to the presence of blood. In reply to questions, the patient recalled an indefinite sense of pressure or slight pain in the left lumbar region during one of his earlier attacks, but aside from that absolutely nothing abnormal had been noticed. Upon examination no tumor could be detected in either lumbar region. There was no abnormal sensitiveness in any part of the abdomen. The prostate was negative. An attempt was made to examine the interior of the bladder by means of a cystoscope and catheterize the ureters. This failed, owing to the cloudiness of the urine from admixture with blood. A second attempt was made the following day, and a view of the bladder obtained; but it was impossible to enter the ureter with a catheter. A small dark mass was found in the region of the left ureter, which suggested either a clot of blood or a papilloma. On the following day, under chloroform anæsthesia, a perineal cystotomy was made, and the bladder thoroughly explored with the finger. As nothing abnormal was found, he was placed upon the right side and the left kidney exposed by an oblique incision in the loin. As soon as the kidney was reached, it was found to be twice its normal size and to present an elastic feeling suggesting fluctuation. An exploring needle was introduced, but nothing but blood was withdrawn.

The bleeding which followed the withdrawal of the needle was so severe as to necessitate instant interference. Accordingly, the incision was extended towards the median line, after the König plan, and the entire kidney drawn into the wound. It was found to be the seat of an enormous, highly vascular new growth, and was consequently removed. The wound was closed by layer sutures, a generous drain introduced, and the patient placed in bed. His recovery was uneventful. Pathological examination of the diseased organ showed it to be the seat of a tubular carcinoma which had involved nearly one-half its substance. (Specimen exhibited.)

DR. F. KAMMERER said it was interesting to note that there were no symptoms of a recurrence in this case. Some time ago, the speaker said, he presented a patient upon whom he had operated for carcinoma of the kidney three years before. The tumor weighed six pounds, and, in order to remove it, it was necessary to make an incision extending from the vertebral column to a point several inches beyond the median line of the abdomen. The patient died of a recurrence about two months ago, having lived for two and one-half years after the removal of the tumor.

RECOVERY FROM EXTENSIVE PERITONITIS FOLLOWING GANGRENOUS APPENDICITIS.

DR. BREWER presented a lad, aged fourteen years, who was seen by the reporter in January last, when he was suffering from an acute abdominal inflammation with intestinal obstruction. Two weeks before he had been seized with an acute abdominal pain, which was accompanied by vomiting, prostration, and elevation of the pulse and temperature. The vomiting continued, and the pain increased in severity and, although it was general at first, soon became localized in the right iliac region. He was seen by a physician, who pronounced it appendicitis, and advised an immediate operation. This was refused, and another physician was called. His symptoms began to subside, and an attempt was made to move the bowels. This failed, as all medicine was vomited, and copious rectal enemata failed to produce other than a clearing out of the lower bowel. There was a gradual distention of the abdomen with tympanites, a rapid loss in weight, a progressive diminution in strength, and persistent vomiting. During this period the temperature was but slightly elevated, and the pulse

was at times below one hundred, but was weak and irregular. Every known method was employed to stop the vomiting and to move the bowels, but without success.

When seen by the writer he was found to be emaciated almost to a skeleton. The eyes were sunken, the nose pinched, the tongue brown and dry, and the teeth covered with sordes. The abdomen was greatly distended, of a board-like rigidity, and tympanitic at its upper portion. The lower portion was flat to percussion, and this flatness extended into each flank for a variable distance, but did not change its position upon moving the patient. There had been absolutely no movement of the bowels or passage of gas for five or six days. Although his condition seemed almost to contraindicate any operative procedure, operation was advised as the only hope. He was removed to Roosevelt Hospital, and under chloroform anæsthesia a large incision was made along the outer border of the right rectus muscle. This opened at once a large collection of pus, amounting to at least a quart. The region of the appendix was explored and a necrosed stump found. The hand introduced into the pelvis found the gangrenous remnant of the appendix, together with a large concretion lying loose among the intestines in this region. A few limiting adhesions were found in the upper portion of the abdominal wound, but below everything was free, and the intestines were reddened, distended, and in places covered with fibrin. The entire abdominal cavity was thoroughly washed with many gallons of hot saline solution by means of a Chamberlain tube. A cigarette drain was introduced into the pelvis and generous gauze packing. No sutures were introduced. The boy's condition at the close of the operation, which was done as rapidly as possible, was extremely critical, and an intravenous saline solution was given, together with a coffee enema and hypodermic stimulation. He rallied from the operation, and on the following day ceased to vomit. As the distention was still great, an attempt was immediately made to move the bowels. Three grains of calomel were given in divided doses, and retained. This was followed by a saline, which was vomited. The saline was repeated on two or three occasions without being retained. High enemata were ineffectual. The vomiting, once started, continued uninterruptedly for twenty-four hours, and was accompanied with great exhaustion. The temperature rose, the pulse became rapid and weak,

and, as all hope for his recovery was abandoned, he was given a large hypodermic of morphine to relieve his sufferings. This was to be repeated every six hours. He sank into a quiet sleep, and after the second dose his vomiting ceased. His temperature fell, his pulse diminished in frequency and became stronger, and, although his distention was extreme, his general condition was apparently much improved. At the end of the second day the bowels moved spontaneously, and he began to take small amounts of nourishment. He improved from this time steadily for three or four days, the bowels moving freely, the distention diminishing, and the amount of nourishment taken constantly increasing. Four days after this improvement commenced, there was a sudden rise of temperature to 105° F., with severe prostration and pain about the right parotid region. At the end of twelve hours there was a well-marked painful tumor about the size of an English walnut at the angle of the jaw. Although this was regarded by all as an evidence of general sepsis, nitrous oxide was administered, and an incision made into the centre of the mass in such a way as to avoid the seventh nerve. No pus was found, but the parotid gland was found to be in a state of inflammatory induration. The wound was packed and the usual dressings applied. The pain was entirely relieved, his temperature soon dropped to a point near the normal, and he again began to improve. Three or four days later he again showed signs of severe infection. There was a gradually rising temperature and pulse rate; he refused food and vomited. An examination of the abdomen was negative, possibly because considerable distention was still present. Twelve hours later there was a severe chill, temperature rose to 105° F. and the pulse to 160. A cold perspiration appeared and the patient seemed to be dying. Vigorous hypodermic stimulation with hot stimulating rectal enemata was resorted to. For a period of about an hour his pulse was so rapid and feeble that it could not be counted, and little or no hope was entertained for his recovery. The abdominal wound was torn open without anæsthesia and the cavity of the pelvis explored with the finger. A large collection of pus was found in the left side of the pelvis, which was evacuated and its cavity packed with gauze. The patient's condition was such that he neither resisted nor apparently suffered discomfort from the operation. This was followed by a gradual improvement, which was not again interrupted

until the complete healing of his wounds and his discharge from the hospital.

During the period of his convalescence large bed-sores appeared on his back, shoulders, and knees, which caused considerable suffering. For a period of several weeks his legs and arms had to be wrapped in cotton to avoid extensive necrosis from pressure. He was discharged from the hospital in an apparently satisfactory condition about seven weeks after his admission.

EXTENSIVE PERITONITIS FOLLOWING ACUTE CHOLECYSTITIS.

DR. BREWER presented a woman, aged twenty-five years, who was admitted to the Roosevelt Hospital in February last suffering from all the evidences of acute general peritonitis. The temperature was 105.4° F., pulse 130, expression anxious, abdomen distended and everywhere tender, muscular rigidity pronounced. As her condition was such that it was impossible to elicit any definite history, and as the physical signs pointed to no particular region as the probable point of infection, under chloroform anæsthesia an incision was made along the outer border of the right rectus muscle. As soon as the peritoneum was opened a large amount of thin seropurulent fluid was evacuated. The intestines were everywhere injected and in places covered with fibrin. The pelvis was full of fluid. The region of the appendix was explored and found to be free from recent lesion. The incision was carried upward to the costal border with a view to exploring the gall-bladder region. This was occupied by an extensive inflammatory exudate, matting together all the tissues and organs in the neighborhood, which were in a state of acute inflammation. The gall-bladder was found embedded in this mass; its walls were thickly infiltrated, but no perforation was found. An incision into its fundus resulted in the evacuation of a considerable amount of thick pus and calculi. A drainage tube was introduced into the gall-bladder and retained by two layers of purse-string sutures. The viscus was then attached to the abdominal wall and the upper portion of the incision united with silkworm-gut sutures. The entire peritoneal cavity was then thoroughly irrigated with hot salt solution by means of a Chamberlain tube. A large cigarette drain was introduced into the pelvis, thick gauze drains passed upward to surround the gall-bladder, and a large mass of gauze

left in the lower half of the incision to retain the intestines. Considerable reaction followed the operation, but within twenty-four hours there was a marked improvement in her condition. The vomiting ceased, the temperature declined, the pulse became stronger, and she was able to take and retain a small amount of nourishment. The bowels were moved on the fourth or fifth day, and were kept freely open for the following week. Her period of convalescence was long and tedious, and was marked by the occurrence of several collections of pus in the region of the gall-bladder, in the pelvis, and between the layers of the mesentery in the central area of the abdomen. Accompanying each one of these there was naturally an elevation of the pulse, and at times chills and sweats were present. After the last of these was evacuated the wounds healed, and she was discharged from the hospital ten weeks after her first admission.

DR. F. LANGE referred to a somewhat similar case coming under his observation. The case was one of intra-abdominal inflammation of doubtful origin. The appendix was removed without much resulting benefit. Subsequently, in order to relieve the intestinal obstruction, the intestines were opened in several places. There was an extensive peritonitis, and the patient died on the fourteenth day. The abdomen did not contain much fluid.

GUNSHOT WOUND OF THE ABDOMEN.

DR. JOHN F. ERDMANN presented a young man who was admitted to hospital on April 19, 1901, suffering from a gunshot wound of the abdomen. Within two hours after the receipt of the injury, Dr. Erdmann opened the abdomen and found six perforations of the intestine and two of the mesentery. Four of the perforations were so close together that it was found necessary to resect about four inches of the gut. The divided ends were united over a Murphy button, which was passed on the fourteenth day. The point of entrance of the bullet was just to the right of the umbilicus. The patient made an uneventful recovery.

RESULT OF OPERATION IN A CASE OF INJURY TO THE WRIST, WITH DISPLACEMENT OF THE RADIAL EPIPHYSIS.

DR. ROYAL WHITMAN presented a boy whom he had shown at the December meeting of the Society shortly after the receipt

of an injury, which consisted of an injury to the lower end of the radius, with displacement of the epiphysis. The treatment, which consisted in chiselling off and replacing the lower fragment, had restored the symmetry of the wrist and had given the boy the perfect use of his hand.

BILATERAL COXA VARA.

DR. WHITMAN presented a boy, sixteen years of age, who, about two and one-half years before, began to complain of indefinite symptoms referred to the hip-joints. There was a certain amount of discomfort, with pain and stiffness in the region of the hips and thighs, but he was able to continue his work on a farm until about six weeks ago. When Dr. Whitman first saw him, two days ago, the symptoms were characteristic of a typical bilateral coxa vara. The patient is unable to sit down without crossing his legs. The greatest separation of the thighs in standing is six inches. Other characteristic signs are the disappearance of the normal lordosis, the anterior displacement of the trochanters, the apparent broadening of the pelvis, due to the elevated trochanters, and the characteristic limitation of the range of motion in the hip-joint.

An important point in differentiating this condition from hip-joint disease is the amount of extension present. In hip-joint disease the range of extension is first limited, while in coxa vara of this ordinary type, in which the neck of the bone is displaced backward, extension is abnormally free. The deformity in this case, which now causes the characteristic rolling gait, is likely to advance until the limbs become crossed,—the so-called scissor-leg deformity. The treatment advised is correction of the distortion by osteotomy.

HYDATID CYST OF THE LIVER, WITH CALCAREOUS PLATES.

DR. HOWARD LILIENTHAL presented a man, sixty-three years old, who suffered for three or four weeks with pains in the abdomen which were regarded as neuralgic in character. Subsequently, a swelling in the epigastric region developed, and upon operation this proved to be a hydatid cyst of the liver, containing, in addition to the hydatid material, a large amount of calcareous

matter. The first operation, which was done on May 12, 1900, in a hospital at Montclair, New Jersey, was followed by two others, which were undertaken for the purpose of removing the calcareous plates in the cyst; these operations proved unsuccessful.

On March 12, 1901, the patient entered Mount Sinai Hospital. A sinus communicating with the cyst still persisted, and upon the introduction of a probe calcareous plates could be felt. Dr. Lilienthal thereupon did a laparotomy with the intention of extirpating the entire sac, but this proved impossible. He therefore split the sac widely, and inserting one hand behind it in the abdomen he pushed up the posterior wall of the sac and removed the plates one after another with a pair of lion-jaw forceps. After their removal, which required considerable force, the sac was scraped with a sharp spoon until its walls were perfectly smooth. The lower part of the wound was sutured and the upper part packed with gauze. A fortnight later the sac was again scraped on account of a slight grating at the bottom of the wound. From that time on the patient made a rapid recovery, and since May 1 the sinus has been closed.

BENIGN STENOSIS OF THE PYLORUS WITH DILATATION OF THE STOMACH; GASTRO-ENTEROSTOMY; ENTERO-ENTEROSTOMY.

DR. LILIENTHAL presented a man, thirty-eight years old, who was admitted to Mount Sinai Hospital March 4, 1901. His family history was negative. The only point of interest in the patient's previous history was that he had been rather freely addicted to the use of alcoholic stimulants.

About seven years ago he began to have "heart-burn" and to vomit, generally at night. He would vomit about a pint of clear fluid two or three times a week; at the same time he had pain after eating. The vomiting increased in frequency, and about five years ago he began to vomit food. The pain after eating became more severe, and the vomiting afforded him considerable relief. Drugs gave him only temporary relief.

About three years ago the man began to wash his stomach, and at the time of his admission to the hospital he was washing it three or four times daily. He thought his stomach could contain about five quarts of fluid. A year ago he vomited about

a pint of dark, coffee-ground material for the first time. Since then he has not vomited blood. He has lost considerable flesh and strength.

Examination of the abdomen revealed a small, non-painful mass, about the size of an almond, lying between the sternal and mammary line; this moved freely with respiration. In the right hypochondrium, extending about three inches below the free border of the rib and occupying the pyloric region, could be felt a resistance which seemed to move with the respirations. The stomach was dilated, and about five pints of fluid could be introduced before the patient asked to be relieved. A test-meal revealed the presence of free hydrochloric acid and an absence of lactic acid.

Operation, March 5, 1901. A gastro-enterostomy and entero-enterostomy were done, according to the modification suggested by Dr. Weir. The lesion in this case proved to be a benign stenosis of the pylorus, with gastric dilatation. Subsequent to the operation, the patient suffered considerably from obstruction and abdominal distention; but he finally recovered, and is now enjoying excellent health. The two buttons which were inserted have not yet been recovered. One of them has been located in the right iliac region by means of the fluoroscope.

In reply to a question as to whether he was in the habit of doing entero-enterostomy in connection with gastro-enterostomy in these cases, Dr. Lilienthal replied that he had done so lately. The operation suggested by Dr. Weir was so easy that he saw no reason why it should not be done, in view of the fact that there seemed to be a distinct indication in the probable avoidance of regurgitation.

DR. KAMMERER said that since he has substituted posterior gastro-enterostomy with the Murphy button for the anterior operation he had not had a single case in which regurgitation occurred. In all, he has done the posterior operation about thirty times. In reply to a question, Dr. Kammerer said he attached the intestine towards the greater curvature of the stomach. Formerly, when he did the anterior operation, he had had many bad results from regurgitation.

DR. BREWER said that Dr. Mayo, at the recent meeting of the American Surgical Association, announced that since he made the anastomosis very close to the greater curvature, he has never

had the slightest trouble from regurgitation, although he does the anterior operation. He has had sixty-seven cases.

PLASTIC OPERATION AFTER REMOVAL OF TUMOR
OF THE UPPER JAW, INCLUDING SOFT
PARTS OF THE CHEEK.

DR. F. LANGE presented a man of about fifty-five years of age, otherwise healthy and well nourished. He presented a rapidly growing carcinoma of the upper jaw involving the skin, which at different times had been subject to incomplete surgical interference—incisions and scraping. Submaxillary glands distinctly involved. After ligation of both external carotids and thorough cleansing of the submaxillary triangle on the corresponding side (left), the jaw was exsected, including the covering soft parts. The mucoperiosteal covering of the hard palate was spared and its edge united to the edge of the mucosa of the cheek. The large cavity remaining was covered with Thiersch skin-grafts, and a flap was dissected from the forehead, having its base over the eyebrow large enough to form the anterior wall of the created cavity. This flap was reflected downward over the eye and its upper edge united to the cut edge at the base of the lower lid. The raw surface was thus looking forward, and it was covered with skin-grafts, as also was the wound remaining where it had been dissected off.

All the grafts, with very few exceptions, in the maxillary cavity united very nicely.

In the beginning of the third week the base of the flap was gradually incised, and about five days later the flap was again reflected downward, having now its base corresponding to the region of infra-orbital edge. Unhappily, it proved not to be sufficiently nourished. The edges and part of the skin-grafts sloughed away, and he had to wait about three to four weeks before it seemed advisable to unite it to the edges of the gap. This delay interfered considerably with the cosmetic result, on account of the retraction and spherical shrinking of the flap. A number of excisions had to be made on its now inner surface to revert the edges, but the union took place by first intention except at two limited points.

First prognosis probably not good on account of the far advanced disease at the time of the operation. In fact, a small recur-

rence had to be dealt with at the time of the second operation in the retromaxillary region. The palate is perfect. Double vision, very pronounced in the beginning on account of the sinking of the eyeball, has now disappeared, except with some extreme and unusual movements of the eyeballs.

In a future case it will be good to remember that the ligation of both external carotids is not favorable to the new circulation into the edge of the reversed frontal flap, or to wait more than two, at least three, weeks and to sever the flap very gradually from its original base. The idea for this operation was suggested to Dr. Lange by a similar operation by Bardenheuer, who used a flap of similar shape with its base at the lower lid over which, after it had been turned downward, the usual Langenbeck skin-flap was united.

DR. KAMMERER said that last summer he operated on a case of carcinoma of the face, and found it necessary to remove one entire cheek. To cover this denuded area, he took a flap involving about half the forehead and brought it down in a reversed position over the cheek, leaving it attached to the forehead by a pedicle in the region of the zygoma. The flap healed nicely, but contracted very much. The pedicle uniting the flap with the forehead was cut in two weeks. No necrosis took place.

DR. LILIENTHAL referred to a flap method of covering defects of the face which he had seen described by Dr. Theodore Dunham in an old number of the *ANNALS OF SURGERY*. The essential feature of the method is that a branch of the anterior temporal artery is buried in the tissues of the face, and forms practically the pedicle of the flap. In a case in which this was done there was absolutely no necrosis. It may not be applicable in a case like the one shown by Dr. Lange, where the defect was very large.

DR. DUNHAM said the operation to which Dr. Lilienthal referred was done several years ago. The idea was to get a flap which would permanently retain the nutrient vessel by which it had always been supplied. In the case in question, the speaker said, he utilized the anterior temporal artery, making the pedicle rather narrow. In order that the flap itself might exactly fit the defect in the cheek, lip, nose, and lower eyelid which it was intended to fill, it was first outlined on the skin with a stick of silver nitrate. The vascular bundle supplying this flap was then care-

fully dissected out and formed a part of its pedicle. The nutrition of the flap remained perfect up to the time that the malignant disease recurred.

DR. LANGE said that in his case the nutrition of the flap was good until he severed it from its base. The ligation of the external carotids in this case was probably responsible for the defective circulation.

ANORECTAL TRANSPLANTATION.

DR. JOHN D. RUSHMORE read a paper with the above title, for which see page 655.

CONTROL OF OOZING AFTER USE OF ESMARCH BANDAGE.

DR. DUNHAM described a method which he has employed for over ten years to control oozing after the use of the Esmarch bandage. When the operation is completed, he has the bandage loosened somewhat, so that bleeding vessels of any consequence can be seen and tied. Then the Esmarch is tightened again, the wound is dried, and snugly dressed with a very tight bandage on the outside, after which the Esmarch is removed. The tight external bandage is left undisturbed for about three hours and then removed. After this, as a rule, the wound is practically dry, and there is never any sloughing of consequence. Dr. Dunham said that in one instance, however, where the House Physician forgot to remove the bandage, the patient nearly lost a finger.

DR. LANGE said that with reference to the control of hæmorrhage, it has been his custom to apply an elastic bandage over the dressing and leave it there for a number of hours.

SHARP KNIVES AT OPERATION.

DR. DUNHAM said that in order to have his knives sharp at the time of operating, it is his practice to boil a small whetstone along with the instruments, thus having it ready for use. When a knife becomes dull, it is readily given a perfect edge by passing it over the stone once or twice.

TRANSACTIONS OF THE CHICAGO SURGICAL SOCIETY.

Stated Meeting, May 3, 1901.

The President, CHRISTIAN FENGER, M.D., in the Chair.

TUBERCULOSIS OF THE PERITONEUM.

DRS. EISENDRATH, ANDREWS, and FENGER presented papers on different phases of tuberculosis of the peritoneum, for which see pages 765, 771, and 787.

DR. CARL BECK mentioned two forms of peritoneal tuberculosis, one which was easily diagnosed, while in the other diagnosis was extremely difficult. Most of the cases of tuberculosis of the peritoneum that had been described in literature were accidentally detected. The cases that were easily diagnosed were those in which operative treatment, as a rule, proved without avail. The accidentally detected cases of tuberculosis of the peritoneum were those in which a diagnosis had been made of something else, either an abdominal tumor of some kind, tumor of the adnexa, etc., and when the abdomen was opened and tuberculosis found, the abdomen was closed with excellent results.

As to appendicitis tuberculosa, this affection seems more frequent than is generally supposed, and many cases of appendicitis that had been operated upon as such, pure and simple, showed afterwards that they were cases of tuberculosis of the cæcum or of the appendix, and the result of the operation showed it to be such, inasmuch as fistula remained for a long time or until the death of the patient. He mentioned a case which had been operated on for appendicitis by Dr. Andrews, who removed the appendix, and in which there remained a fistula for a long time; the patient developed symptoms of intestinal obstruction, which brought him under the speaker's observation. The intestinal obstruction was chronic. He waited a few days before subjecting

the patient to operation. When he examined the site of the lesion which had been operated on previously, the region of the appendix showed outside no symptoms of tuberculosis; but on peeling off the peritoneum and going a little into the free peritoneal cavity he found a tubercular peritonitis, and he was compelled to resort to exclusion of the bowel because the radical elimination of the tubercular cæcum was impossible. He cut across the ascending colon and across the ileum, closed both ends of the eliminated bowel, and made a side-to-end anastomosis of the ileum and colon, left the cæcum behind, but split the fistula of the appendix a little farther, so as to leave it more open for further treatment. The young man recovered from the operation, but large tubercular nodules and cheesy masses formed, showing typical tuberculosis of the cæcum. The patient left the hospital, but began to decline gradually. Death must have followed, but he did not know when and under what circumstances it occurred.

He had seen another case of operation for chronic appendicitis with persistent fistula in which the symptoms of partial intestinal obstruction existed. Tuberculosis was likewise found in this case, although the patient had been operated on for appendicitis pure and simple. Such cases were undoubtedly of more frequent occurrence than was generally thought.

As to the treatment of tuberculosis of peritoneum by operative or non-operative measures, there is a wide difference of opinion among surgeons. It seems from the remarks of Professor Fenger that laparotomy was not very promising in pronounced cases of tuberculosis of the peritoneum. That cases of peritoneal tuberculosis had been and can be cured without laparotomy was evidently true. He presented a patient who had had tuberculosis of the peritoneum two years ago for which no operation was performed. There was no doubt as to the diagnosis of the case. There were multiple foci of tuberculosis of the peritoneum. The patient was treated on general principles the same as tubercular patients are treated, it being largely hygienic. In most of the cases which have recovered without operation the objection could be raised that they were not true tuberculosis, but in the case under consideration the tuberculosis of other organs was so extensive that there could be no doubt as to the diagnosis. Speaker had operated on a number of cases of tuberculosis of the peritoneum by opening the peritoneum, either exposing it to the

air or using other methods of treatment, and he had had a number of deaths among such cases. This patient, who had also tuberculosis of the glands of the neck, as was evident by extensive scars on both sides, had also tuberculosis of both testicles, one of which was removed, while the other was left after having been scraped and healing had taken place. Examination would reveal no symptoms of tuberculosis at the present time, neither in peritoneum nor in testicle or neck. Such cases could not be treated better with operation. Usually, however, different diagnoses are made. For instance, a tumor of the abdomen or of the adnexa would be diagnosed, the abdomen opened, when it would be found that the case was one of tuberculosis of the peritoneum. In that event, nothing remained but to close the abdomen; the result in such cases being usually good. Many surgeons recall cases in which excellent results were obtained by opening the abdomen in cases of tubercular peritonitis. But the question still remains unsettled.

DR. HALSTEAD presented a specimen obtained post-mortem from a case operated upon by him in December, 1899. The clinical history was as follows: A young woman, unmarried, aged nineteen, had up to two weeks before been well. At that time she noticed that the abdomen was larger than usual. This rapidly increased, and was associated with indefinite abdominal pain and obstinate constipation. There was some dysuria and a decided diminution in the quantity of urine voided. When she presented herself for examination at his office, the abdomen was considerably distended, and the presence of free fluid in the abdominal cavity could be demonstrated. Examination of the thorax was negative, as was also that of the liver and pelvic organs. No abdominal tumor was to be found. The general appearance of the patient was fairly good; the skin was markedly pigmented, giving a decidedly bronzed appearance which suggested Addison's disease. The sclera showed icteric hue. The temperature was 97° F. and the pulse 120. There was a slight puriform vaginal discharge which on microscopic examination showed no tubercle bacilli or gonococci. She was advised to remain in bed, and was thus kept under observation for one week. At the end of this time she consented to have an operation. At the second examination, made two days after the first, an area of dulness could be outlined extending from a point about half-way between the ensiform and the umbilicus to the pubis. This area was wider in the meso-

gastrium than above and below, measuring in its widest part about four inches. On palpation a distinct tumor mass, spindle-shaped in outline, gave the sensation of fluctuation. This was freely movable laterally, but appeared to be attached above and below. On each side of this dull area there was tympanic resonance on percussion until the level of the free abdominal fluid was reached. The diagnosis of abdominal tuberculosis was made by excluding other possible causes of ascites. There was no history of tuberculosis in the family.

Three weeks after the first symptoms had been noted, the patient was operated upon at the Chicago Policlinic Hospital. The abdomen was opened by a median incision. A large quantity of straw-colored fluid escaped. The intestines were found firmly adherent in many places; the peritoneum, both parietal and visceral, was closely studded throughout its entire extent with small miliary tubercles. The great omentum was rolled upon itself, forming a mass in lumen which was fluid. The lower end of the omental tube was attached to the anterior abdominal wall close to the pubis. No attempt was made to separate the adherent coils of intestine. The fluid was evacuated as completely as possible and the abdominal cavity drained. The patient's condition during the first twenty-four hours following was not materially changed from what it had been previous to the operation. The temperature remained subnormal, the pulse was rapid, and the mind clear. At the end of the first twenty-four hours she was suddenly attacked with severe epistaxis. This was controlled by plugging the nares. Within a few hours hæmorrhage from all the mucous membranes began. At the same time large purpuric spots appeared on the chest and extremities. These increased in size and number until nearly the whole surface of the body was covered. Large intermuscular hæmatoma also developed. The temperature rose to 100° F. The pulse gradually became imperceptible, and she died in coma thirty-six hours after the operation.

A post-mortem examination was made by Dr. Fütterer a half-hour after death. General abdominal tuberculosis of the ascitic variety, with slightly enlarged mesenteric glands and firm adhesions matting together the whole intestines, was found. No foci were found in the lungs or pleura. There was no old tubercular disease of the tubes. The intestinal mucous membrane was

not examined. Cultures from the peritoneal cavity were negative. There was no evidence of a pus infection of the peritoneum.

The points of interest in connection with this case are:

- (1) The insidious onset of the disease.
- (2) The persistent subnormal temperature.
- (3) The extreme pigmentation of the skin, without adrenal disease.
- (4) The presence of a tumor in the median line of the abdomen extending longitudinally from above the umbilicus to the pubis. The tumor being formed by the great omentum becoming rolled upon itself with its lumen filled with fluid.
- (5) The fatal termination of the case, death following thirty-six hours after the operation with symptoms of a hæmorrhagic diathesis. This was probably due to a toxæmia of some sort; the toxic substance probably being liberated as a result of the changes which occurred consequent on the operation.

Dr. Halstead also reported a case of healed tubercular peritonitis. The patient was a young woman aged twenty, who was operated on for what was thought to be suppurative peritonitis following a rupture of the appendix. The illness began suddenly with a chill and severe pain in the abdomen, which in the course of a few hours became localized in the region of the appendix. The temperature was high, ranging above 103° F. from the first. The abdomen soon became greatly distended, with marked rigidity of the abdominal muscles. The abdomen was opened through an incision along the outer border of the right rectus muscle on the third day after the onset of the disease. The peritoneal cavity contained a large quantity of turbid fluid. The walls of the appendix were greatly thickened, but no rupture had occurred. The entire peritoneum was thickly studded with tubercles and dense adhesions firmly bound together the intestinal coils. The mesenteric glands were enlarged, some reaching the size of an English walnut. The appendix was removed; the abdominal cavity irrigated with salt solution and drained by tubular and gauze drainage. The patient made a very slow recovery, leaving her bed at the end of three months. As soon as she was able to travel she was sent to Colorado. She remained there for two years and completely regained her health. At the time she left her bed she weighed about eighty-five pounds; when she returned to this city after two years, she had gained fifty-five pounds in weight.

As a result of the operation she had a ventral hernia, for which he operated in the summer of 1899, three years after the first operation. In operating for the cure of the hernia the abdominal cavity was again opened. Careful inspection showed that scarcely a sign of the former extensive tubercular disease existed. All of the tubercles had disappeared; the peritoneum was everywhere normal in appearance. The intestinal coils were nowhere adherent. The mesenteric glands had mostly resumed the normal appearance. There were few calcareous deposits to be seen in the mesentery; these were surrounded by a zone of white fibrous tissue. Several of these deposits with the surrounding fibrous tissue were excised and subjected to microscopic examination. No tubercle bacilli were found.

Since the last operation, the patient has resided in this city, and has been examined a number of times. There are no signs of tubercular disease in any part of the body.

The interesting features of this case are:

(1) The acute character of the disease; simulating closely acute appendicitis in the beginning and suppurative peritonitis at the time of operation.

(2) The extensive abdominal tuberculosis; a part at least of which must have existed previous to the onset of the acute symptoms, although the patient was apparently in good health.

(3) The complete healing of the disease, as is evidenced by return of health, the disappearance of all of the other tubercular lesions of the peritoneum.

DR. D. N. EISENDRATH stated that he brought out two or three points in the diagnosis of tubercular peritonitis in his paper, and cited two cases which illustrated each variety. One of these Dr. Andrews saw with him about three years ago. A patient, who was apparently well up to the time of the attack, was suddenly seized with symptoms of acute intestinal obstruction, and it was believed to be due to some band. Laparotomy showed that there was a diffuse tubercular peritonitis, with great thickening of the muscular wall and peritoneum and some of the coats of the intestine, causing intestinal obstruction.

Another variety he touched on was the resemblance of tubercular peritonitis to typhoid fever. About two years ago he saw a case in which the temperature varied between 103°-4° F. for a period of four weeks, resembling typhoid fever. In fact, typhoid

fever had been diagnosticated, and only a laparotomy cleared up the diagnosis, besides the physical examination which was made later on.

DR. FENGER remarked that the case presented by Dr. Beck illustrated that patients could recover from the miliary form of tuberculosis, with exudate. Strictly speaking, it would require that the abdomen be tapped and tuberculosis proven.

As to the adhesive form of tuberculosis, in which there is no peritoneal cavity, it was absolutely senseless in his opinion to cut into a cavity that did not exist, or to cut into the abdominal wall to get near to a cavity that did not exist.

As to the cheesy, ulcerative form of tuberculosis, it was pretty generally agreed that operation does not do much good. A great many of these patients died because the tuberculosis was of such form and had reached such a stage and extent that it was incompatible with life. The miliary form with exudate showed the highest percentage of recoveries. There was one thing, however, that to him explained the difficulty of securing a uniform opinion as to the uselessness of any procedure in tuberculosis, and it was this, that tuberculosis is such a chameleon-like disease that it was difficult to tell which cases would and those which would not recover. Tuberculosis in any part of the body, with the exception of the brain or of the meninges, might be recovered from. There were few diseases that caused so many surprises as tuberculosis. The disease disappeared in many instances. There were even recoveries from the so-called ulcerative form of tuberculosis of the peritoneum. It was exceedingly difficult to arrive at a united opinion regarding tuberculosis of the peritoneum. Tuberculosis of joints had had its period of *furore operativa*, and surgeons had probably gone a little too far; and there was no reason why the same thing should not obtain with reference to tuberculosis of the peritoneum, many cases of which had been operated upon on sight, or as soon as the diagnosis was made. A great many false ideas had been entertained regarding the effect of air and sunlight on the peritoneum. He thought it was time that the conservative period should come for tuberculosis of the peritoneum.

MECHANICAL VERSUS SUTURE METHODS FOR INTESTINAL APPROXIMATION.

DR. JACOB FRANK read a paper with the above title, for which see January, 1902, issue of *ANNALS OF SURGERY*.

DR. ALEXANDER HUGH FERGUSON did not think it fair to compare the Murphy button with all methods of suturing indiscriminately. To-day, surgeons have a choice of two methods,—the extra-intestinal and the intra-intestinal method with the continuous or interrupted suture. The continuous suture which he prefers is the Cushing right-angle suture, or the half-back stitch suture which he uses himself, and the Halstead for the interrupted. For the intra-intestinal method, he prefers the Connell suture (all the knots on the inside of the bowel), which he has used recently with excellent success. If he were to choose between the intra- and extra-intestinal method, from his experience he would select the intra-intestinal method as devised by Connell and discard all others. This was his experience both experimentally and practically. There were certain places, however, where the intestinal suture could not be used very well. It could be used in gastro-enterostomy. It could be used in cases of pyloric stenosis in connection with the Heinicke-Mikulicz operation; but it could not be easily used when the surgeon had to remove a section from the duodenum, as he had to do in one case. In operating on a carcinoma of the hepatic flexure and removing it, he found the duodenum involved. He could not use the suture after removing a section from the duodenum at the head of the pancreas, and therefore applied a Murphy button. In end-to-end anastomosis the suture or the button could be used, but in lateral anastomosis on a small bowel he prefers the suture method, and would use the Connell suture in preference to all others. He had a case recently in which there was a small knuckle of intussusception which it would be dangerous to excise on account of the condition of the child and the long time it had been ill. Suturing was the best method to employ in that case. He remembered on another occasion in doing a pelvic operation where he had to remove a large myoma of the uterus and double tubo-ovarian abscesses. After the pathological tissues had been removed, the lower portion of the sigmoid and upper part of the rectum, to the extent of nine inches in all, were denuded of all their coverings except the mu-

cosa, consequently he resected the gut and applied the Murphy button successfully. He could not use very well the suture so low down in the pelvis. In an operation for tubular stricture of the rectum, where one decides to perform the Bacon operation, the Murphy button can be used more advantageously than the suture. So at present there are fields of intestinal surgery where to his mind the application of the button is better, and where in other localities the suture is infinitely preferable to the button. The time it takes to perform an operation plays a very important part, particularly in a case of strangulated hernia, or in any of those operations where the bowel is not viable. A quick operation is of vital importance. Take a patient with some elevation of temperature where obstruction had taken place. There may be no elevation of temperature at first, but in three days probably there is, and the abdominal cavity may be partly or wholly filled with fluid. At that time a rapid operation goes very far towards saving the patient.

In comparing the rapidity with which these operations can be done by the same men, he finds that he can apply the Murphy button, the Frank coupler, or similar appliances, a little more rapidly than to suture the intestine, probably about one-third more expeditiously. In resecting the bowel and dealing with the mesentery, the same time is consumed in either method. In using the Connell suture it takes forty-three different movements, varying a little according to the number of sutures applied. In the application of the Murphy button it takes thirty-four moves by the same man. With the use of the interrupted suture, with all knots on the inside after the method of Connell, it takes forty-eight moves. He has therefore been using in the acute cases, where time was a life-saving element, the Murphy button or the Frank coupler. These devices he places in the same category, although it takes a few more moves to apply the Frank coupler than the Murphy button. The suture has a number of advantages and disadvantages. There is less leakage from the use of the Murphy button or Frank coupler than from the use of sutures, and infinitely more leakage when the surgeon is not an expert with the needle and thread. A great many operations are done throughout the country by operators who have never performed perhaps more than one or two of the operations under discussion, consequently he is inclined to believe that mechanical devices applied

internally would be safer in the hands of those of limited experience.

The advantages to be gained by the Frank coupler and Murphy button are well known. A disadvantage of the Murphy button or the Frank coupler is that in many instances the former device has been retained in the intestine for a long time. He mentioned two cases in which there was leakage from the use of the button. In one of these he removed the cæcum and tried to make an end-to-end anastomosis of the large with the small bowel, using the largest sized Murphy button, which he thought was a foolish thing to have done. After doing this he established drainage, and the button came out on the side. In a second operation, where he put the end of the small bowel into the side of the large bowel, using a button of smaller size, the patient recovered.

Three months ago he had a case at the West Side Hospital of strangulated (a right femoral) hernia, made an incision through the right rectus muscle, applied the Murphy button, and a fæcal fistula formed at the lower angle of the wound. The button passed through the alimentary canal in due time; the fæcal fistula closed, and the patient recovered. Trouble was not with the button, but he did not remove as much of the bowel as he ought to have done; there probably was some necrotic spot that had given way. This is his explanation of it.

He asked Dr. Raymond C. Turck, who has control of the Post-Graduate Experimental Laboratory, for statistics as to the number of operations performed there on dogs. Some of the cases that he (Ferguson) had operated on himself; some were operated on by Dr. Turck, but the large number of them were performed by doctors from different parts of the country. There were 600 abdominal operations on dogs, the majority of them being done by sutures. Deaths occurred from peritonitis, the result of leakage in a number of cases. Of 115 anastomoses with the button, the mortality was 2 per cent. from peritonitis. Of 300 end-to-end anastomoses by the Connell suture, the mortality was 3 per cent. This probably was not fair as to the Connell suture, inasmuch as the number of operations is larger, and were performed by men who had just begun to use the suture first. Of fifty operations in which the Czerny-Lembert and Halstead sutures were used, the mortality was 22 per cent., due to peritonitis from leakage. Of fifty cases in which the Maunsell operation was

performed, the mortality was 25 per cent. Of fifty cases in which interlocking sutures were used on the bladder as employed by Dr. Turck, there were no deaths.

In looking over his own records of intestinal work he finds that his success attending the use of the suture and button is about equal.

DR. E. WYLLYS ANDREWS stated that he was one of the first to use the Frank coupler in the human subject. After demonstrating the use of the coupler to his class on the dog, and killing the animal twenty-four hours afterwards, the bone bobbin was so decalcified that it was absolutely reduced to soft pulp within that length of time. The dog was operated on by Dr. Frank himself, and, had not the bowel been quadrated with four Lembert stitches, it would have parted. Now he understands that Dr. Frank has various degrees of hardness for his decalcified bone bobbins, hence the objection to the original coupler has been overcome. In his own case the patient made a quick recovery. He could not agree with Dr. Frank that ease of application in unskilled hands made the use of the coupler or button preferable to any suture method. Its ease of application was not a recommendation for its adoption, if it would induce men to perform laparotomies who would never do but one or two such operations in a lifetime. Intestinal surgery is, and always should be, in the hands of specialists. The Connell suture is the best stitch he has ever tried. First beginning with the Maunsell operation, that had seemed to him a much better suture method than any yet devised. Since the publication of the Connell method he had used that suture a good many times. In one case he had the assistance of Dr. Connell, at which time he resected a gangrenous hernia, and the patient made a beautiful recovery. A short time thereafter he made use of this suture on the duodenum, in a case of pylorotomy, which proved to be one of the easiest and safest he had ever performed. He has done the Heinicke-Mikulicz operation with the Connell suture, and his results have been excellent. It was not fair to compare the perfected button statistics with those of all the abandoned or poor stitch methods. The best suture methods only should be compared, methods which put the stitches right through the whole thickness of all layers of the bowel and hold them fast, just as mechanical devices do. Mechanically, such a suture is as strong as any button, because it as it were clamps the bowel walls together. They are so strongly fastened that they must hold until

enough force has been applied to tear the bowel asunder. This is distinctly not the case with the Czerny-Lembert.

While equally strong and exerting the same clamping action as the button, the Connell suture differs from it in not causing a gangrene of the included edges.

DR. F. GREGORY CONNELL stated that, so far as he had been able to determine, the Connell suture had been used in human beings thirteen times, and of this number three of the patients died. In one case death occurred on the eighth day after the operation, post-mortem examination revealing no evidence of defective suturing. The other two died of shock immediately after operation. After experimentation and carefully studying the literature of the subject, he finds that the greatest fault with the intestinal suturing is that the stitches yield. Rosenthal gives 50 per cent. of all deaths following intestinal suturing as being due to yielding of the stitches. This, in all probability, was due to the fact that the submucosa was not included in the stitch. As has been demonstrated by Halstead, the submucosa must be included in the stitch, as a thread of this tunic offers more resistance to suture yielding than do the muscular and serous coats combined. In attempting to include *some* of the fibres of the submucosa, there is a great probability that the needle will penetrate into the lumen, and if so we have the knot of the suture on the peritoneum and a part of the stitch in the lumen of the bowel. Dr. Frank mentioned the work of Chulmski, who makes the statement that in all of the suture methods in which leakage occurred it took place at the site of the knot. Now, if the knot is placed within the lumen, this danger of leakage will be eliminated, and by including all coats, the danger of yielding is absolutely avoided, thereby removing two very important elements of the mortality in enterorrhaphy.

DR. FRANK said that an excellent suture method had been devised by Dr. Gregory Connell, a member of the Society, and one which he believed ranked as high as any of the suture methods thus far devised. However, it was a little strange that in this city (Chicago), where mechanical devices for intestinal anastomosis had their home, that so little should be said in their favor, and that surgeons had changed their minds in favor of suture methods. His chief object in presenting a paper was to get a consensus of opinion and a comparison of results by both mechanical devices and suture methods.

INDEX TO SURGICAL PROGRESS.

BONES AND JOINTS.

I. The Treatment and Prevention of Arthrogenous Contraction of the Knee. By DR. CARL BRUNS. The author describes shortly or mentions the various orthopædic and operative means of treating and obviating contracture of the knee subsequent to gonitis. Splints or plaster dressings applied with or without preliminary forcible extension of the joint frequently are entirely unsatisfactory and recontraction takes place. Resection has generally been the treatment of last resort, and even after resection, with its disadvantages of shortening and mutilation, there may be recurrence of the flexion. The author accuses the muscles of being the cause of contracture, and bases the treatment he recommends on this belief. His treatment is as follows: Examine the patient carefully and find out which of the hamstring muscles are principally at fault. Expose the offending hamstring by a longitudinal incision, divide it near its insertion, free its distal end to the necessary extent, and suture it to the quadriceps tendon. Close the wound or wounds. Immobilize until firm union is assured. Bruns has applied the above measures in three cases. In his first case contractures resulted from fungus; the disease was cured; but in spite of all means of conservative treatment faithfully used for two years the deformity insisted on recurring. Transplantation of the biceps into the quadriceps tendon gave a perfect result. The second case was one of contracture subsequent to *gonitis gonorrhæica phlegmonosa*. The disease had long been cured, but contracture persisted in spite of all treatment. The biceps and semitendinosus were exposed and divided at their insertions. Although the patient was deeply anæsthetized, at-

tempts to straighten the knee caused very marked retraction of these two muscles. Complete extension of the knee was foregone, the two muscles were sutured to the quadriceps tendon, and the limb immobilized in its contracted position (forty degrees). After three weeks the dressings were removed and massage begun. Slowly and without passive movements the knee straightened spontaneously. The patient recovered, and is able to walk without the slightest pain. The third case was one of chronic articular rheumatism, in which the knee contracture was so great in both limbs that the patient had been bedridden for years. The result obtained from tendon transplantation was very satisfactory.—*Centralblatt für Chirurgie*, 1901, No. 6.

JOHN F. BINNIE (Kansas City).

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INDEX TO VOLUME XXXIV.

- A**BBE, ROBERT, Treatment of rupture of intestine, 294.
- Abdomen, Gunshot wound of, 321, 832; followed by faecal fistula, 424.
- Abdominal cavity, Foreign bodies accidentally left in the, 499, 678; Lange's cross incision above pubis, 431.
- Agar-agar injections to produce connective tissue, 273.
- ALEXANDER, SAMUEL, Intraperitoneal rupture of the bladder treated by laparotomy, 209; Treatment of undescended testis, 296.
- ALLEN, DUDLEY P., Pneumococcus arthritis, Primary, in the knee-joint, 527.
- ALLIS, OSCAR H., Examination of head injuries, 187.
- Amputation, Interscapulo-thoracic, 320.
- Anæsthesia, Local, in operation for strangulated hernia, 178.
- ANDREWS, EDWARD WYLLYS, Tuberculosis herniosa and appendicitis tuberculosa, 787; Technique of intestinal anastomosis, 849.
- Aneurism, cirroid, Excision of, after ligation of external carotid artery, 414; of superior profundi humeri artery, 398; thoracic aorta, Treatment of, by introduction of wire and electricity, 143.
- Anioma of face, Electrolysis for, 421.
- Ankylosed joints, Restoration of function in, 452.
- Anorectal transplantation, 655.
- Anthrax, Carbolic acid treatment of, 711; Two cases of facial, treated by injections of carbolic acid, 555.
- Aorta, aneurism of thoracic, Treatment of, by introduction of wire and electricity, 143.
- Appendicitis with extensive peritonitis, recovery, 828; followed by acute intestinal obstruction, 660, 708; followed by suppurative pericarditis, 548; followed by subphrenic abscess, 729; tuberculosa, 790; Review of Leuzmann's Work on, 721.
- Arm, cedema of, from circumferential scar, Plastic operation for, 182.
- B**ECK, CARL, Fracture of the carpal end of the radius, with associated injuries, 249; Differentiation between inflammatory processes and neoplasms of the bones by the Röntgen rays, 753.
- BECK, CARL (Chicago), Peritoneal tuberculosis, 839.
- Biceps, Subcutaneous rupture of the, 445.
- Birdshot wounds, Multiple, 419.
- Bladder, exstrophy of, Operative treatment of, 25, 423; Intraperitoneal rupture of the, treated by laparotomy, 209; Intraperitoneal rupture of the, 600; Obturator hernia of, 796; Stone in, due to ligatures and bone spicule, 715, 716; of female child of four

- years, 819; Tumor of, removed under spinal anæsthesia, 575.
- BLAKE, JOHN B., Blood in relation to surgical diagnosis, 361.
- BLAKE, JOSEPH A., Fracture of carpal scaphoid, with dislocation of the semilunar bone, 297; Chronic tenosynovitis, 576; Subphrenic abscess, 703.
- Blood, Studies of the, in relation to surgical diagnosis, 361.
- Blood changes induced by ether as an anæsthetic, 329.
- BLOODGOOD, Results of operations for sarcoma of bone, 594.
- BOLTON, PERCIVAL R., Forward dislocation of the semilunar bone, 291; Removal of testes and seminal vesicles for tuberculosis, 306; Multiple birdshot wounds, 419.
- Bone diseases, Value of the X-rays in the diagnosis of, 753.
- Brain, Wounds of the venous sinuses of the, 81, 187.
- Breast, Adenofibroma of, 181; cancer of, Best incision in operations for, 135, 308.
- BREWER, GEORGE E., Typhoidal osteomyelitis, 181; Excision of external carotid arteries for inoperable cancer of tongue, 567; of larynx, 568; Case of cervical rib, 578; Double ureters, 582; Arthrotomy for loose cartilage in knee-joint, 423; Fæcal fistula following gunshot wound, 424; Mayo's operation for septic arthritis of knee, 825; Carcinoma of kidney, 827; Recovery from extensive peritonitis following appendicitis, 828; Recovery from extensive peritonitis following cholecystitis, 831.
- BROWN, F. TILDEN, Ununited fracture of the forearm, 416.
- Burns by X-rays, 808.
- BUXTON, BERTRAM H., Teratoma of the testis, 391.
- CABOT, RICHARD C., Blood in relation to surgical diagnosis, 361.
- Cæcal hernia, 155, 440.
- Cancrum oris, Cautery excision, 289.
- Carotid artery, external, Ligation of, for hæmorrhage, 21; external, Excision of, for inoperable cancer of the tongue and floor of the mouth, 567; Excision of, for inoperable cancer of the larynx and pharynx, 568; external, Ligation of, for cirroid aneurism, 414.
- Carwardine's Surgery, Review of, 326.
- Cervical ribs, 578, 637.
- Chicago Surgical Society, Transactions of the, 193, 320, 839.
- Cholecystitis followed by extensive peritonitis, recovery, 831.
- COLEY, WILLIAM B., Radical cure of hernia, 1; Tendency to recurrence after amputation at the hip-joint, 587; Teratoma of the testis, 391, 415; Ligation of external carotid artery for cirroid aneurism, 414.
- Connective tissue, Artificial production of, by agar-agar injections, 273.
- CONNELL, F. GREGORY, Technique of intestinal anastomosis, 850.
- CORNER, EDRED M., The pathology of the sphincters, 457.
- CORSON, EUGENE R., The X-ray and photographic technique necessary to bring out bone detail, 560.
- Coxa vara, Bilateral, 833.
- CRESSY, A. Z. C., Cancrum oris treated by cautery excision, 289.
- CURTIS, BENJAMIN F., Carcinoma of liver simulating abscess, 185; Fracture and dislocation of the carpal bones, 298; Pylorectomy for carcinoma, 418; Treatment of cystic kidneys, 420; Deformity following resection of knee in

- children, 430; Stenosis of the larynx, 433; Milton's method of exposing the anterior mediastinum for ligature of the innominate artery, 472.
- D A COSTA, JOHN CHALMERS**, Blood changes induced by ether as an anæsthetic, 329.
- DAVIS, GWILYM G.**, Wounds of the venous sinuses of the brain, 189; Operations for mammary carcinoma, 308.
- DAWBARN, ROBERT H. M.**, Death from leakage around a Murphy button after gastro-enterostomy, 304; Operations for saddle-nose, 307; Excision of external carotid arteries for inoperable cancer, 569.
- DEAVER, JOHN B.**, Mortality of operation for obstructive jaundice, 165; Recurrences after operations for sarcoma, 594; Mortality in operations for obstructive jaundice, 441; Treatment of extra-uterine pregnancy, 442.
- Diaphragm**, Excision of part of the, together with sarcoma of wall of thorax, 281.
- Dislocations of shoulder**, irreducible, Operative treatment of, 450.
- DOWD, CHARLES N.**, Empyema; Incision of pulmonary pleura, 179; Adenofibroma of breast, 181; Spontaneous disappearance of gastric tumors, 303; Angioma of face treated by electrolysis, 421; Excision of the knee-joint, 422.
- DUNHAM, THEODORE**, Stricture of the œsophagus, 822; Plastic of face, 837; Control of oozing after use of Esmarch bandage, 838; Sharp knives at operations, 838.
- EISENDRATH, DANIEL N.**, Splenic enlargements and splenectomy, 198; Pathology, symptomatology, and diagnosis of tuberculosis of the peritoneum, 765, 844.
- Elbow**, Resection of, for tuberculosis, 431.
- ELIOT, JR., ELLSWORTH**, Plastic for liberating circumferential scar of arm, 182; Abscess of the liver, 184, 186; Traumatic rupture of the intestine, 293; Abscess of the liver, 481; Tuberculosis of the testis, 574; Tubercular tenosynovitis, 577.
- ELSBERG, CHARLES A.**, Subphrenic abscesses after appendicitis, 729.
- Empyema of thorax**, 179.
- Enterorrhaphy with aid of the O'Hara forceps**, 441.
- ERDMANN, JOHN F.**, Gangrenous intestine in ventral hernia, 298; Perforating gunshot wound of abdomen, 832.
- Esmarch bandage**, Control of oozing after use of, 838.
- Ether as an anæsthetic**, Effect of, upon the blood, 329.
- EVANS, WILLIAM A.**, Enlarged spleen, 196.
- Extra-uterine pregnancy terminating in suppurating hæmatocele**, Treatment of, 159, 442.
- Exstrophy of the bladder**, Operative treatment of, 25.
- FÆCAL fistula following gunshot wound**, 424.
- Fallopian tube**, Obturator hernia of, 796.
- Femur**, Treatment of fracture of the neck of, 61.
- FENGER, CHRISTIAN**, Splenic enlargements and splenectomy, 197; Tuberculosis of ileocæcal region, 207; Treatment of tuberculosis of the peritoneum, 771, 845.

- FERGUSON, ALEXANDER HUGH, Technique of intestinal anastomosis, 840.
- FISK, ARTHUR L., Strangulated hernia operated under local anæsthesia, 178.
- Foreign bodies accidentally left in the abdominal cavity, 499, 678.
- FOWLER, GEORGE R., Treatment of rupture of intestine, 295.
- Fracture of forearm, Ununited, 416; of tibia, Ununited, 431.
- Fractures and Dislocations, Stimson's Treatise on, Review of, 719.
- Fractures, irreducible, Operation upon, 448.
- FRANK, JACOB, Mechanical versus suture methods of intestinal approximation, 846.
- FRAZIER, CHARLES H., Neuropathic affection of the bones, 437.
- G**ANGRENE of bowel in ventral hernia, 298.
- Gastro-enterostomy for benign obstruction of pylorus, 300; for gastroptosis with vomiting, 302.
- Genital tuberculosis, 601.
- GIBBON, JOHN H., Two cases of left cæcal hernia, 155, 316; Enterorraphy with aid of the O'Hara forceps, 41.
- GIBSON, CHARLES L., Abscess of the liver, 184; Treatment of rupture of the intestine, 295; Gastro-enterostomy for ulcer of the stomach, 304.
- Gunshot wound of abdomen, 832.
- GWYER, FRED. WALKER, Operation for saddle-nose, 268, 306; Sarcoma of superior maxilla, 300.
- H**ALSTEAD, DR., Peritoneal tuberculosis, 841.
- HAMMOND, L. J., Aneurism of the superior profunda humeri artery, 398.
- HARRIS, MALCOLM L., Splenectomy in splenic anæmia or primary splenomegaly, 111, 193, 202.
- HARTE, RICHARD H., Sarcoma of superior maxilla, 437; Cæcal hernia, 441; Observations on fractures of the skull, 534.
- HARTLEY, FRANK, Operative treatment for exstrophy of the bladder, 25.
- HAYNES, IRVING S., Treatment of ununited fractures, 417.
- Hernia, Cæcal, 153, 316, 440; with volvulus of ileum, 316; Obturator, of bladder and of Fallopian tube, 796; Report of eight hundred and fifty-five cases of operation for radical cure of, 1; Strangulated, Operation under local anæsthesia, 178; strangulated femoral, Excision of intestine, 318; Tuberculosis of contents of, 787; umbilical, Operation for the radical cure of, 276; Ventral, 572; Ventral, with gangrene of bowel, 298; Worsteds truss in inguinal, 523.
- Hernia operations, Fibres from tendon of external oblique muscle as suture material in, 323.
- HERZOG, MAXIMILIAN, Splenectomy in splenic anæmia or primary splenomegaly, 111, 193, 200.
- Hip-joint amputations for sarcoma, Tendency to recurrence after, 584.
- HOTCHKISS, LUCIUS W., Technique of prostatectomy, 427; Resection of elbow for tuberculous disease, 431; Acute intestinal obstruction following appendicitis, 660, 709.
- HUBBARD, J. C., Blood in relation to surgical diagnosis, 361; The worsteds truss in inguinal hernia, 523.
- Humeri, superior profunda, Aneurism of the, 398.

Humerus, Traumatic epiphyseal separation of the upper end of the, 450; Operative treatment of irreducible dislocations of, 450.
 HUNTINGTON, THOMAS W., X-ray burns and their treatment, 808.
 Hydatid cyst of liver, 833.

ILEOCÆCAL valve, Tuberculosis of, 205.

Innominate artery, ligature of the, Method of exposing for, 472.

International Clinics, Review of, Series XI, Vol. i, 327.

Interscapulo-thoracic amputation, 320; Ultimate results of a case of, 712.

Intestinal approximation, Mechanical versus suture methods for, 846; obstruction following appendicitis, 660, 708.

Intestine, Anastomosis of, with aid of the O'Hara forceps, 441; Traumatic rupture of the, 293.

Intussusception, 178.

ISRAEL, Chirurgische Klinik der Nierenkrankheiten, Review of, 726.

JAUNDICE, obstructive, Mortality in operations for, 165, 441.

Jaw, Plastic after removal of tumor of upper, 836.

JOHNSON, ALEXANDER B., Prostatectomy, 426.

Joints, ankylosed, Restoration of function in, 452.

JONES, WILLIAM, Report of case of recovery from perforating typhoid ulcer of intestine after operation, 176.

JOPSON, DR., Anthrax in Philadelphia, 711.

Jugular vein, internal, Resection of, for sinus phlebitis, 571.

KALTEYER, FREDERICK J., Blood changes induced by ether as an anæsthetic, 329.

KAMMERER, FREDERIC, Intussusception, 178; Carcinoma of liver, 185; Benign obstruction of pylorus treated by gastro-enterostomy, 300; Posterior gastro-enterostomy for gastroptosis with vomiting, 302, 305; Nephrectomy for renal cysts, 419; Silver-wire matting for ventral hernia, 573; cervical ribs, 578, 637; Technique of gastro-enterostomy, 835; Plastic of face, 837.

KEEN, WILLIAM W., Two cases of ligation of external carotid artery for hæmorrhage, 21; Tendency to recurrence after amputation at the hip-joint for sarcoma, 584.

Keloids, Multiple, 706; Thiosinamin in the treatment of, 708.

Kidney, Adult, of fœtal type, 203; Horseshoe, 580; Acute surgical, 581; Primary carcinoma of, 827; Surgery of true cystic, 811.

Kidneys, Multiple cystic degeneration of, 419; Tuberculosis of, Nephrectomy, 434; Israel on the Surgical Diseases of, Review of, 726.

KILIANI, OTTO G. T., Chronic lymphangitis, 183; Keen's operation for spasmodic wry-neck, 428; Paracentesis of the pericardium, 823; Unilateral laryngectomy, 824.

Knee, Treatment and prevention of arthrogenous contraction of, 851; Mayo's operation for septic arthritis of, 825.

Knee-joint, Excision of the, 422; Arthrotomy of, for loose cartilage, 423; Deformity following resection of, in a child, 429; Hæmarthrosis of the, 451; Pneumococcus arthritis of the, 527.

KRAMER, SIMON PENDLETON, Artifi-

cial production of connective tissue by injection of agar-agar, 273.

LANGE, FREDERICK, Murphy's button, Retention of, after gastro-enterostomy, 304; Suprapubic cross incision to expose pelvic tumors, 431; Ventral hernia, 573; Ureterectomy, 579; Nephrolithotomy, 580; Nephrectomy, 581; Plastic after removal of tumor of upper jaw, 836.

Larynx, Complete stenosis of, relieved by incision and skin-grafting, 432; and pharynx, Inoperable cancer of, treated by excision of the external carotid artery, 568; Stenosis of, treated by skin-grafting, 649; Partial removal of, 824.

LATHROP, WALTER, Fracture of the skull, 401.

LE CONTE, ROBERT G., Results of operations for sarcoma of bone, 597; Ultimate results of an inter-scapulo-thoracic amputation, 712.

Leg, Extensive ulceration of, 299.

Leuzmann, Die entzündlichen Erkrankungen des Darms in der Regio ileocæcalis, Review of, 721.

LILIENTHAL, HOWARD, Thyroid extract in cases of non-union after fracture, 417; Intestinal implantation of ureters for exstrophy of bladder, 423; Hydatid cyst of the liver, 833; Benign stenosis of the pylorus, 834; Plastic of face, 837.

Liver, Abscess of the, 184, 481; Hydatid cyst of, 833.

LULL, CABOT, pneumococcus arthritis, Primary, in the knee-joint, 527.

Lymphangeitis, Chronic, 183.

MAMMARY carcinoma, Best incision in operations for, 135; 308.

MCARTHUR, L. L., Splenic enlargements and splenectomy, 199;

Adult kidney of foetal type, 203; Tuberculosis of ileocæcal valve, 205; Tendon fibres from external oblique muscle as suture material in hernia operations, 323.

MCCOLLIN, DR., Personal immunity from recurrence after amputation of thigh for sarcoma, 596.

MCCOSH, ANDREW J., Skin-grafting in the treatment of complete stenosis of the larynx, 433, 649.

MANN, JR., ARTHUR H., Suppurative pericarditis following appendicitis, 548.

Maxilla, superior, Sarcoma of the, 300, 437; inferior, Non-development of the, 430.

MAYO, WILLIAM J., Operation for the radical cure of umbilical hernia, 276.

Mediastinum, Milton's method of exposing the anterior, 472.

MEYER, WILLY, Treatment of cirroid aneurism of temple and scalp, 415; Nephrectomy during spinal cocainization, 434; Resection of the internal jugular vein for sinus phlebitis, 571; Ventral hernia, 572; Tuberculosis of the testis, 574; Tumor of bladder removed under spinal anæsthesia, 575; Intestinal obstruction following appendicitis, 709.

MORTON, THOMAS S. K., strangulated femoral hernia, Excision of intestine, 318.

Murphy button, Retention of, 304; Death from leakage around, 304.

MUTSCHLER, LOUIS H., Two cases of facial anthrax, 555; Treatment of anthrax, 711.

NEPHRECTOMY for cystic degeneration, 419; for tuberculosis, 434; for acute surgical kidney, 581.

Nephrolithotomy, 580.

Neuropathic affection of bones, 437.

New York Surgical Society, Transactions of the, 178, 293, 297, 414, 423, 567, 703, 822.

NIEMACK, J., Surgery of true cystic kidney, 811.

Nose, saddle-, Operation for, 268, 306.

OBTURATOR hernia, 796.

OCHSNER, A. J., Splenomegaly, 197.

Œsophagus, Stricture of the, 822.

Orthopædic Surgery, Whitman's Treatise on, Review of, 717.

Osteomyelitis, Typhoidal, 181.

PATELLÆ ligamentum, Subcutaneous rupture of the, 446.

Pericarditis, Suppurative, following appendicitis, 548.

Pericardium, Paracentesis of, 823.

Pertoneum, Tuberculosis of, 765, 771, 839.

Peritonitis, Extensive, following appendicitis, recovery, 828; following cholecystitis, 831.

Philadelphia Academy of Surgery, Transactions of the, 187, 308, 316, 437, 584, 711.

PLUMMER, JR., S. C., Interscapulothoracic amputation, 320; Gunshot wound of the abdomen, 321.

Pneumococcus arthritis of the knee-joint, 527.

PORTER, CHARLES B., Successful excision of a sarcoma of the wall of thorax and diaphragm, 281.

PORTER, MILES F., Stone in the bladder of a female child of four years, 819.

PORTER, WILLIAM G., Wound of the longitudinal sinus, 188.

Progressive Medicine, Vol. i, 1901, Review of, 455.

Prostatectomy, 426; and prostatotomy, 444.

Pulmonary pleura, Incision of,

during operation for empyema, 179.

Pylorus, benign obstruction of, Gastro-enterostomy for, 300, 834.

RADIUS, Fracture of the carpal end of the, with associated injuries, 249.

RIDLON, JOHN, Treatment of fracture of the neck of the femur, 61.

ROBERTS, JOHN B., Congenital anterior dislocation of the tibia treated by arthrotomy, 286; Operations for mammary carcinoma, 309; Vesical calculi due to ligatures and bone spicule in the bladder, 715.

RODMAN, WILLIAM L., Best incision in operations for mammary carcinoma, 135; Wounds of the venous sinuses of the brain, 188; Results of operations for sarcoma of bone, 597.

ROGERS, JOHN, Treatment of spasmodic wry-neck, 428; Chronic laryngeal stenosis, 432.

Röntgen ray photographic technique, 560.

ROSS, DR., Wound of the superior longitudinal sinus, 190; Cæcal hernia, 440.

RUSHMORE, JOHN D., Anorectal transplantation, 655.

SADDLE-NOSE, Operation for, 268, 306.

Saphenous vein, Congenital ossification of, 706.

Sarcoma, Frequency of recurrence of, 375; of superior maxilla, 437.

Scaphoid bone of the carpus, Fracture of the, 297.

SCHACHNER, AUGUST, Foreign bodies accidentally left in the abdominal cavity, 499, 678.

SCUDDER, CHARLES L., Strangulation of the testis by torsion of the cord, 234.

- Semilunar bone, Forward dislocation of the, 291, 297.
- Seminal vesicles, Removal of, for tuberculosis, 306, 601.
- SHOEMAKER, GEORGE ERETY, Treatment of suppurating hæmatocele following extra-uterine pregnancy, 159, 442.
- Shoulder dislocations, irreducible, Operative treatment of, 450.
- SIPPY, BERTRAM W., Splenic enlargements and splenectomy, 194, 201.
- Skin-grafting in the treatment of complete stenosis of the larynx, 649.
- Skull, Fracture of the, 401, 534.
- Spermatic cord, Torsion of, producing strangulation of the testis, 234.
- Sphincters, The pathology of the, 457.
- Spinal cocainization, Nephrectomy during, 434.
- Splenectomy, 111, 193.
- STEELE, D. O. K., Splenomegaly, 199.
- STEWART, D. D., Treatment of aneurism of thoracic aorta, 311.
- STEWART, FRANCIS T., Cæcal hernia, with volvulus of ileum, 316.
- STIMSON, LEWIS A., Treatise on Fractures and Dislocations, Review of, 719.
- Stomach, carcinoma, Excision of pylorus, no recurrence after eighteen months, 418; Dilatation from benign stenosis of the pylorus, 834; Surgery of, 300, 302.
- Subphrenic abscess, 703, 729.
- TAYLOR, WILLIAM J., Cæcal hernia, 440.
- Tendon fibres from external oblique muscle as suture material in hernia operations, 323.
- Tenosynovitis, Chronic, 576.
- Teratoma of the testis, 391, 415.
- Testis, Strangulation of, by torsion of the cord, 234; Teratoma of, 391, 415; Tuberculosis of, 306, 574; Undescended, 296.
- Thiosinamin in the treatment of keloids, 708.
- Thorax, sarcoma of the wall of the, Successful excision of, 281.
- Thyroid extract, Use of, in delayed union of fractured bones, 417.
- Tibia, Congenital dislocation of, treated by arthrotomy, 286; Ununited fracture of the, 431.
- TILTON, BENJAMIN T., Multiple keloids, 706.
- Toe substituted for amputated finger, 447.
- Tongue, Inoperable cancer of the, treated by excision of the external carotid artery, 567.
- Tonsillotomy, hæmorrhage after, Ligation of external carotid artery for, 21.
- Torticollis, Traumatic, 299; spasmodic, Treatment of, 428.
- Truss, Worsted, in inguinal hernia, 523.
- Tuberculosis of appendix vermiformis, 790; of the elbow, Resection for, 431; of the genitals, 601; of ileocæcal valve, 205; of kidney, Nephrectomy under spinal cocainization, 434; of the peritoneum, Pathology, symptomatology, and diagnosis of, 765; Treatment of, 771, 839; of seminal vesicles and testis, 306; of tendon-sheaths, 577; of the testis, 574.
- Tuberculosis herniosa, 787.
- TURNER, WILLIAM K., Ureteral anastomosis, 816.
- Typhoid ulcer of intestine, perforating, Recovery after operation, 176.
- Typhoidal osteomyelitis, 181.

UMBILICAL hernia, Operation for the radical cure of, 276.

Ununited fracture of forearm, 416; of tibia, 431.

Ureter, Double, 581.

Ureteral anastomosis, Case of, 816.

Ureterectomy, 579.

Urethra, Traumatism of the Male, Review of Wasiliew on, 327.

Uterus, Large fibromyoma of, 431.

VESICAL calculi due to ligatures and bone spicule in the bladder, 715, 716; in female child of four years, 819.

Volvulus of ileum, 316.

WALKER, JOHN B., Treatment of undescended testis, 296.

Wasiliew, Die Traumen der Männlichen Harnröhre, Review of, 327.

WHARTON, HENRY R., Wounds of the venous sinuses of the brain, 81, 187, 191; Vesical calculus formed about a silk ligature, 716.

WHITMAN, ROYAL, Cured traumatic torticollis, 299; Extensive ulceration of leg, 299; Deformity following resection of the knee in a child, 429; Non-development of inferior maxilla, 430; Ununited fracture of the tibia, 431; Congenital ossification of saphenous vein, 706; Review of Treatise on Orthopædic Surgery,

717; Result of operation for deformity following wrist injury, 832; Bilateral coxa vara, 833.

WILLARD, DE FOREST, Aneurism of thoracic artery treated by introduction of wire and electricity, 143; Wounds of the venous sinuses of the brain, 191; Treatment of thoracic aneurism, 311, 316; Results of operations for sarcoma of bone, 596.

WOOLSEY, GEORGE, Diagnosis of abscess of the liver, 185; Treatment of rupture of the intestine, 295; Undescended testis, 296; Thiosinamin in the treatment of keloids, 708; Intestinal obstruction following appendicitis, 708.

Wrist-injury involving forward dislocation of the semilunar bone, 291, 297; Result of operation for deformity following, 832.

Wry-neck, spasmodic, Keen's operation for, 428.

WYETH, JOHN A., Frequency of recurrence of sarcoma, 375; Results of operations for sarcoma of bone, 599.

X-RAY burns and their treatment, 808; Photographic technique, 560.

X-rays in diagnosis of bone diseases, 753.

YOUNG, HUGH H., Genital tuberculosis, 601.



Vol. XXIV.

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TABLE OF CONTENTS

ORIGINAL MEMOIRS.

- I. Contribution to the Pathology, Etiology, and Treatment of Subcutaneous Abscesses after Appendicitis. By *Charles A. Elsberg, M.D.* 729
- II. On the Differentiation between Inflammatory Processes and Neoplasms of the Glands by the Röntgen Rays. By *Carl Beck, M.D.* 733
- III. On the Pathology, Symptomatology, and Diagnosis of Tuberculosis of the Peritoneum. By *Daniel N. Hirschman, M.D.* 765
- IV. Treatment of Tuberculosis of the Peritoneum. By *Christian Fenger, M.D.* 771
- V. Tuberculosis of the Hernia and Appendicitis. By *Edward Charles Andrews, M.D.* 787
- VI. On the Hernia of the Bladder and the Fallopian Tube. By *Reginald Clouston, F.R.C.S.* 795

- VII. Note on X-Ray Burns and their Treatment. By *Thomas W. Hustington, M.D.* 803
- VIII. Contribution to the Surgery of True Cystic Kidney. By *J. Niemack, M.D.* 811
- IX. Ureteral Anastomosis. Report of a Successful Case. By *William K. Turner, M.D.* 816
- X. Stone in the Bladder of a Female Child of Four Years. By *Miles E. Peck, M.D.* 819

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

STATED MEETING, May 22, 1901 822

TRANSACTIONS OF THE CHICAGO SURGICAL SOCIETY.

STATED MEETING, May 2, 1901 839

INDEX TO SURGICAL PROGRESS.

BONES AND JOINTS 841

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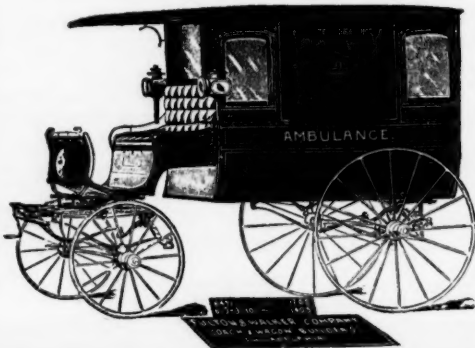
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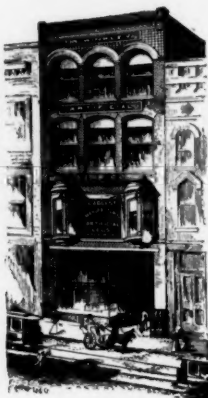
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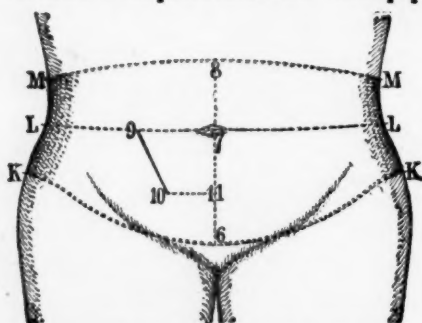
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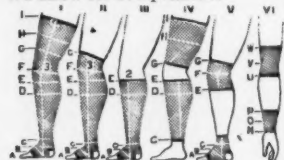


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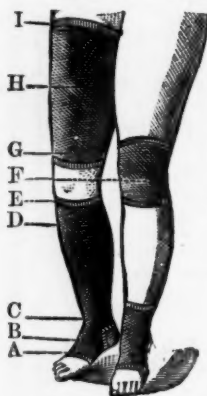


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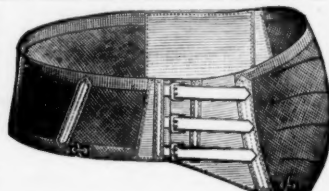
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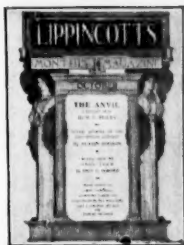
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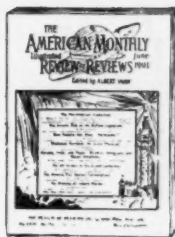
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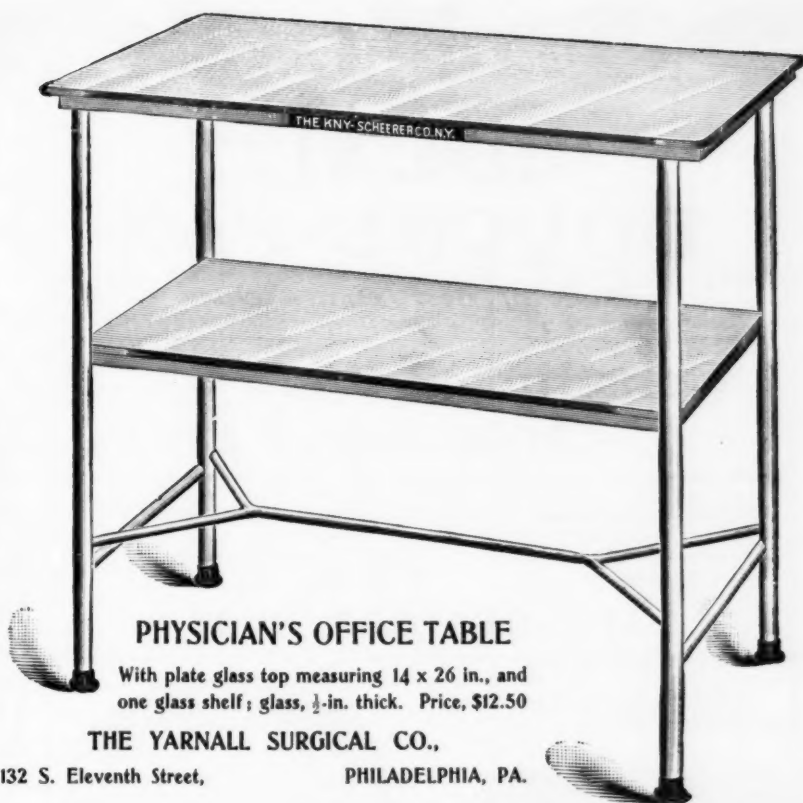
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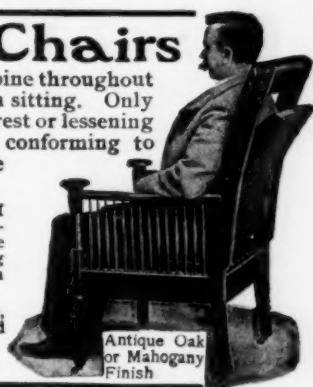
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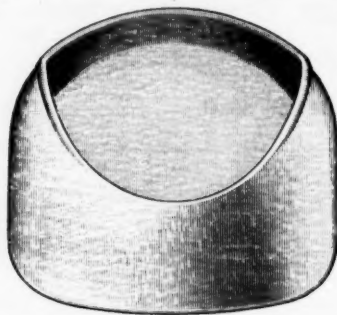
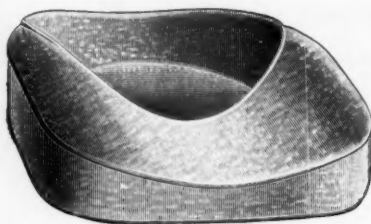
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